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Bilgram's Bevel Gear Cutter.

In the manufacture of machine tools it rarely happens that so radical a change of applied principles is made as has been done in this machine. The difficulty of making correct bevel gears is known to all who have had experience in this direction. The principal difficulty is that in the correctly-formed tooth of a bevel gear the curvature of the sections from end to end is not uniform, and hence the application of formed tools cannot give correct results. The principle of what might be called a radial or polar planer, where the motion of the tool is invariably directed to one point—*i. e.*, the apex of the gear, with a lateral swinging feed motion, guided by a template—can advantageously be applied only to large gears; while for the manufacture of correct smaller gears, say below 15 or 16 inches diameter, no cheap and adequate means has been known. The machine shown in the engraving seems to completely fill this void.

The principle of the machine can, perhaps, be best explained as follows: It is possible to make with any system of interchangeable gears a rack which will correctly gear with any wheel of the set. Any wheel that gears correctly with this rack must, therefore, also gear correctly with any other wheel of the set; and from this it follows that if any number of wheels are made to gear correctly with this rack, they must also gear correctly with one another. If the wheels were to be made of some soft material, say wax, the teeth could be formed by simply rolling the blank into the rack, care being taken that the pitch line of the blank will roll on that of the rack without slip. The desirable clearance can be obtained by giving this rack just the converse of clearance. Gears are, however, made of material that cannot be removed by pressure, and the process must therefore be modified. The teeth of the rack might be made of hardened steel, with sharp edges at the ends; and by giving them a lateral motion the material could be cut away instead of being pressed to one side. The diagram, Fig. 1, shows distinctly how the tooth of an involute rack would cut its way through the rolling blank, thus forming one of the spaces between two teeth.

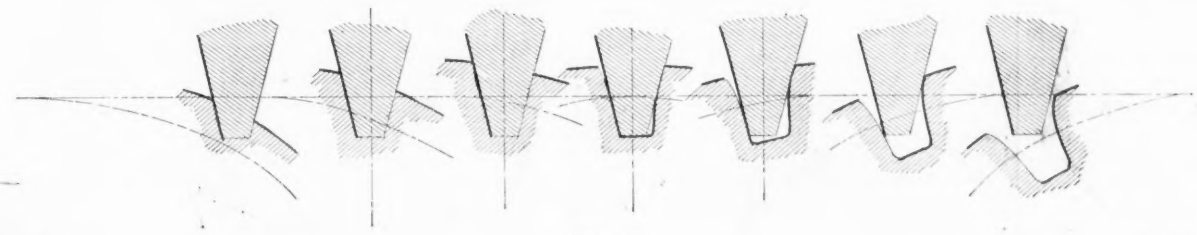
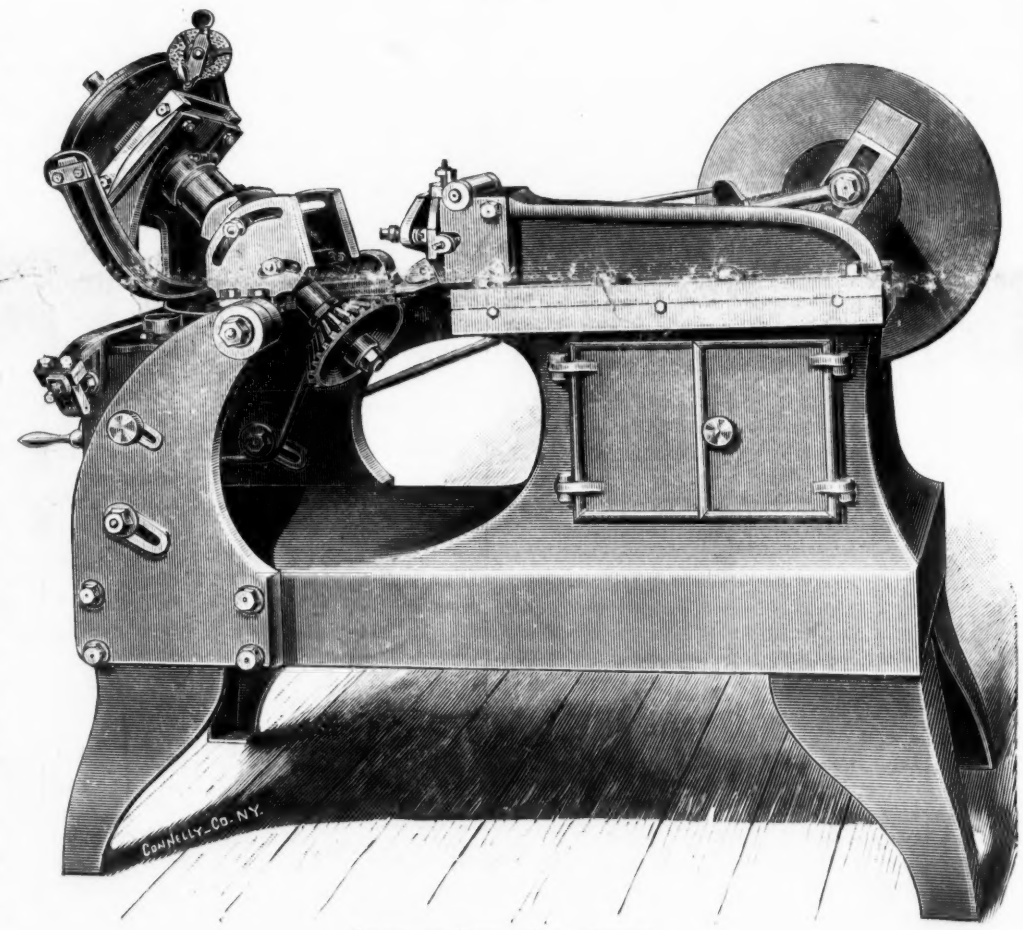


FIG. 1.



BILGRAM'S BEVEL GEAR CUTTER.

This is, in fact, the process by which this gear-cutter accomplishes its work. The cutting tool represents one tooth of a rack pertaining to an interchangeable set of gears, and it obtains a reciprocating motion in the manner of a shaper tool, while the blank receives a movement as though it were rolling on its pitch surface. In bevel gears the tool representing the rack tooth, while cutting, passes through the varying depths or pitches; therefore the straight line, or involute rack tooth, is the only available one for this purpose. The tool, instead of running parallel with the pitch line, must run parallel with the bottom of the space. This will be more readily understood if it is considered that the rack of a bevel gear is nothing else but a bevel gear forming a pitch angle of 180° at the apex, or a flat, circular disk with teeth converging from the circumference towards the center. The tool, in cutting, should follow the outline of the teeth of this imaginary plane wheel; and it is evident, therefore, that only one side of the converging space can be formed correctly at a time.

The machine, then, consists of two principal parts—the shaper, which holds and operates the tool, and what may be called the evolver, which holds and moves the blank. In order that the blank shall imitate the movement of a rolling cone, the axis must, in the first place, be moved in the manner of a conical pendulum. To accomplish this, the bearing of the arbor which carries the blank is secured in an inclined position between two uprights to a semi-circular horizontal plate, which can be oscillated on a vertical axis passing through the apex of the blank. To complete the rolling action, the arbor must, in the second place, receive simultaneously the proper rotation, and this effect is produced in the machine by having a portion of a cone (corresponding with the pitch cone of the blank) attached to the arbor, and held by two flexible steel bands stretched in opposite directions, thus preventing this cone from making any but a rolling motion when the arbor receives the before-described conical swinging motion. One end of each of the two bands, of course, is attached to the cone, while the other is attached to the framework of the evolver.

Mathematically speaking, a cone does not terminate at the apex, but is extended beyond, and thus consists of two opposite sides or surfaces meeting in the apex. Basing on this principle, the rolling cone above described is placed on the side of the apex opposite that on which the blank is placed, in order to avoid an interference with the tool.

The feed mechanism effects a slow intermittent movement of the semi-circular plate which supports the inclined arbor, thereby producing a slowly progressing rolling of the blank while the reciprocating tool forces its way through the metal. The feed can be reversed by the turning of a knob, or disengaged altogether, permitting the blank to be rolled to the one or the other side by a hand-crank.

The arbor carrying the blank can be rotated independent of the rolling cone by means of a worm wheel, worm and index plate, which enables the blank to be presented to the cutting device at properly spaced divisions corresponding with the number of teeth of the desired wheel.

It is essential that the tool should be so adjusted that the lowest point of the cutting side should move exactly towards the apex of the blank, and, in order to set the tool, a gauge is provided by which the tool can be adjusted. A distance block is used between this gauge and the tool; this mode admits of a high degree of accuracy, since variations of distances can readily be detected by the touch when the eye ceases to discern.

When a wheel is to be cut out of the solid, the tool is at first adjusted at a slight distance from its correct position, and after each cut the feed motion of the evolver causes the blank to slowly roll, and allows the tool to cut out the stock in the manner shown in the diagram. All spaces are now treated in the same manner by using the index device, whereupon the tool is properly adjusted for one and then for the other side, each adjustment being followed by a repetition of the process in order to finish both sides of the teeth.

In securing the blank to the arbor, great care must be exercised in placing its apex exactly in the center of the evolver. A special device enables the operator to gauge the distance of the ends of the teeth from the center of the evolver, and, whenever this distance agrees with that calculated from the drawing, the apex of the blank is in its right place.

The inclination of the arbor which holds the blank is made adjustable, so as to adapt it to the angle of the desired gear. This adjustment must be exactly concentric with the center of the evolver, *i. e.*, the apex of the blank. The rolling cone is made detachable, in order that it may be replaced by such cones as correspond with the angle of the blank to be cut; but as the number of cones required would be unlimited, means have been devised to make a limited number of cones suffice.

The tool consists of a triangular bar of hardened steel, forming at the point an angle of 30°, 15° on each side, and held by a special holder. By grinding, it can be more or less truncated to suit the pitch of the gear to be cut. By this form of tool a much higher degree of accuracy is attainable than with tools having curved faces made to a gauge. The proper up and down and sideway adjustment is effected by two slides working at right angles, and operated by screws. The clamp which fastens the tool-holder is so constructed that it also clamps these said slides to the apron, securing the necessary stability. The apron is fitted with great care; the box in which the apron works is made in parts, and the faces are turned true

with the pinholes, in order to get these faces exactly at right angles with the pin. The latter is fast in the apron, and revolves in the two sides, in which it has taper fits that the wear may be taken up. A device for lifting the apron during the return stroke prevents the dragging of the tool. The oscillating movement of the connecting-rod is employed for this purpose, by having a bar hinged at one end to a clamp which can be shifted on the connecting-rod while the other end impinges on the apron. By a lifting of the crank end of the connecting-rod, the loose end of this bar is pushed forward and the apron is lifted. It is easy to so adjust the clamp that this lifting action will occupy the time of the return stroke.

The tool-bar is moved by a Whitworth quick-return motion, which is attached directly to the belt pulley. A double countershaft connected by cone pulleys is employed to change the speed if a shorter or longer sroke is desired.

Gears cut on this machine are practically as nearly perfect as it is possible to produce plane surfaces on a planer. For this reason a careful preparation of the blanks is essential.

One feature of involute gearing, which in practice is often troublesome, can be fully met by gears cut by this machine in a manner to be described. Whenever a pinion with a comparatively small number of teeth gears with a large wheel, there is a tendency of the points of the teeth of the wheel to cut into the flanks of the pinion. Reuleaux recommends that the number of teeth of the smallest gear of a set of interchangeable wheels should not be lower than 30. In practice this defect is, however, hardly noticeable when the number of teeth is not less than 20, but for a smaller number it becomes perceptible. In spur gearing the difficulty is generally met by giving the teeth of pinions more than the theoretical rounding; but this expedient is not a perfect cure, as may readily be attested by the experience of those who have cut 12-tooth involute pinions. Bevel wheels being always made in pairs, the above difficulty can be overcome by making the tooth-face of the wheel shorter than usual, *i. e.*, by cutting it off at that point of the face-involute, which, in running, will come in contact with the root of the involute of the pinion. By the extent to which the face of the wheel teeth is shortened by this measure, that of the pinion teeth is increased, and the flanks are made to correspond. It is evident that where this correction has been applied, the pitch line of the pinion is nearer to the base of the teeth, and that of the wheel nearer to the top than in the ordinary practice. Brehmer Bros., Philadelphia, have several of these machines in operation cutting gears.

Bill's Troubles With a Countershaft—The Dude Machinist—Forcing a Gear on a Shaft—Wrestling With an Arbor.

By James F. Hobart.

Bill has "gone up." He is not "up a tree" nor "up the spout," but up a ladder. Bill runs a 26″ Putnam lathe, and he has lots of fun with his countershaft. When anybody wants the ladder, they always go to Bill. It stands by Bill's lathe most of the time, and not a day passes but Bill has a picnic up on that ladder among the pulleys, belts, and black oil.

Once they had tight and loose pulleys on that counter, and they worked first rate. One day a chap came along with a "patent double-adjustable improved compression clutch," and told the boss that the shifting-belt business used up too much time. Boss looked it all over, and "thought so" too. They pulled down the good old belt-shifter, and put up the friction concern. How nice it worked! You could run a thread tool clear up to a shoulder and yank the shipper. The belts would give one big "flop," and away goes the tool on the starboard tack.

This clutch worked first rate for three months. Bill says he never had a better rig than during that time. One day it "stuck." That day Bill's troubles began. He hunted up that old block ladder, and has stuck to it ever since. When that clutch got an a "tear" it was simply terrible. Sometimes Bill could stop his lathe, and sometimes the lathe stopped Bill. One day, when cutting a thread, the clutch stuck. Bill yanked until the shipper handle broke, but the clutch was game. It hung on. The tool-post walked up against the chuck, and teeth on the change gears got mad and left. Bill pulled off the belt and went aloft with hammer and wrench. The clutch "let go" easy enough after he had "looked at it," but he had to hold the shipper all the time to keep the clutch in.

Bill rigged a string to hold the shipper when he was turning long work. One day it wouldn't ship in. Bill looked at it as usual with his hammer, and broke a piece out of it. Bill looked sorry, but he couldn't cry, and Boss gave him an old-fashioned rig with two wooden pulleys, each carrying a stud and a straight dog on the shaft between them. Bill's great grand-daddy had a rig just like it, only the dog was shrunk on a square shaft, and it staid where it was put. This rig has got a set screw. It gets loose every night and twice per day. Otherwise it worked nice for a year; then the dog got worn, and it would slip out. Bill twisted a wire around the handle and slipped the wire over the head of one of the cap-bolts. It slipped off once in a while, and Bill unscrewed the bolt $\frac{1}{16}$″, and put a loop of the wire under the head. It is all right now, but poor Bill handles that wire 300 times a day 300 days in the year, and it takes a second to do it and two seconds to take it off—270,000 seconds, 75 hours—at $3 per day, just $22.50 a year.

Boss says he is going to put up the old tight and loose pulleys again, and it will pay him, too. It takes longer to stop and start. The loss is about the same as with the wire fastener, but Boss will save $20 per year in wear and tear of belts, pulleys, hangers, shafting, and lathe. The friction clutch is *the thing* if it would stay good, but it needs overhauling "every Sunday," and costs more in ten years than ten loose pulley rigs.

Stebbins has got a dude machinist. Said "Dude" is a study. He makes lots of sport for the boys, and—don't know it. He wears a $2\frac{3}{8}$″ collar, white duck overalls, and spends his time watching a diamond point tool and cleaning his finger nails. Dude has rigged a nice little tin cup on a nice little bracket, which swings on the lathe tail-stock. He keeps a nice little piece of clean waste in the cup. Every time Dude touches a tool, or a wrench, or his calipers, he wipes his nice little fingers on the nice little waste, and then puts them in his little pockets.

Dude don't work in a dirty shop because he is obliged to. No, sir! The whole shop understood that point before it had known Dude ten hours. Dude is to be a supermechanical engineer. He has been "through college, you know," and has walked through the best technical school; and now is following very good advice in "getting a little shop practice, you see," and feels *so* nice that dirt can't stick to him.

Can you use an arbor decently? Look around a little and see how many of the boys do so. Watch Tom Hanks, over there at the arbor rack. He has tried six or seven arbors in that little collar which he wants to turn up—there, he's found one. It is about $\frac{1}{2}$″ by 10″ long. Watch him drive it into the collar. He keeps screwing the collar down with his hand, until he can't start it any farther. Don't go to the driving-off tool with the little raw-hide mallet. Not a bit. As he goes by Henry's vise, he clasps his hand around the little collar, and strikes the end of that arbor three times on the vise jaw, scuds to his lathe, slips on a dog and turns up the collar.

"Here, Tom," said boss the next day, "How, in creation, did you turn that collar yesterday?" "Why," said Tom, "I turned it up on an arbor, of course. What's the matter with it?" "Matter! Why the hole ain't in the middle of the collar, that's all, and ain't that matter enough?" "I don't see how it could help it," said Tom. "Well, I can make a pretty good guess at it," said boss, "and I am going to show you, too. Bring that arbor up here." Tom brought the arbor, and gave it to boss. "Look at that, Tom," said he. "There's a dent in this end, right in the edge of the center," and boss showed Tom the marks of the vise jaw on the end of the arbor, where it had jammed iron into the center $\frac{1}{16}$″. "Look at that, you infernal blockhead, and see if you 'see how it could help it,'" said boss, as he stuck the arbor up within an inch of Jones' nose. "There's a lot of you fellows here that ought to be consolidated. Take you all together, and boil you down, the whole gang would make just one decent jackass. A man that treats arbors in this fashion ought to go to piling cord wood for a living."

Just then, Mike Flemming brought back a 2″ arbor, which he had been using down stairs. It was about 30″ long. Mike slouched along until he got within 20 feet of the arbor rack, gave the arbor a pitch in the direction of the rack, and watched it go end over end, and bring up ker-slap among the pile of big arbors on the floor.

"You blasted fool!" roared boss, as he made a jump for Mike, and collared him. "You don't know any more than the rest of them, and they are all blamed fools!"

"W-w-what's t-the m-m-matter," sputtered Mike, half frightened by the racket. "Matter!" Said boss, "Why, you compound high-pressure idiot, you use my arbors in that shape, and then ask 'what's the matter.'" "Well," said Mike, catching on to the situation, "This is a pretty time for you to begin to talk about it. If you pretend to boss a shop five years, and never noticed anything wrong about these arbors before, and ain't satisfied now, why, all I've got to say is, that its very poor judgment to begin now. Why didn't you start the thing when you first came on deck? A thing that's been going on for years under a man's eyes, and called all right, is a pretty thing to yank a man up like that for, and it shows pretty plain that all the fools ain't among the men;" and Mike went down stairs in a huff.

Boss scratched a flea out of his ear. He walked over to the arbor rack, and took a look. There they were, 40 or 50 arbors in the rack, and a cart load on the floor, big arbors, little arbors, poor arbors, horrid arbors, scrap-iron, chunks of shafting, rough castings. Boss felt tired, and went to thinking.

"How's that for a racket, Tom," said Mike, as they lugged an old 2″ shaft into the shop. "Racket," said Tom, "why there's nobody to blame for his poor arbors, and the way they get used, but the boss himself. It's just as you told him, Mike, and he knows it, too."

Bob Parker is getting "shop experience" too. Bob wears a smutty jumper and a pair of horrid over-alls. They were clean Monday morning, but who would know it? Dirt sticks to Bob just as mud sticks to boots, and shop kinks stick to him, too. Bob came into the shop ten days after Dude dawned on us. Bob don't have to work for his living either. His father is M. M. on the P. Q. & Y. Railroad. Bob was everywhere about that railroad. He was into everything, and got so numerous that M. M. got him a chance in our shop to get rid of him, and keep him out of danger.

Bob likes Dude. He despises him too; and so do all hands, but there is lots of fun to be had out of Dude. Bob hadn't been in the shop two hours before he sized up Dude's collar, over-alls and waste cup; and "tumbled" to the whole racket. Bob soaked a piece of waste in the grease under the bolt cutter, and when Dude was picking up his eye-glass, Bob swapped his nasty waste for that in Dude's cup. Dude straightened up, put a little oil on his tail-center, stuck his fingers in the waste cup and felt if his neck-tie was straight and made sure that his nose was at hand.

Poor Dude! His lines are hard ones in that shop. There are ten Bobs in the shop and they all claim Dude as lawful game. He will stay ten months in our shop, and when he goes to Waston's draughting room will know how to turn 4″ counter-shafts with a diamond point tool, and to hate Bob.

No use for Dude to fool around machine shops. He has mistaken his calling. He should get a job to show up nobby tight pants for an up-town tailor, or a job as "cured patient" in a doctor's office, and his ability may be appreciated.

Bob is a character in the shop. No matter how dirty the job, Bob is always on hand. He loves the work. He likes to go off and overhaul an old steam engine, or explore a wheel pit. He has only been in the shop two years, but he can do more than some men who have "learned the trade," and worked at it ten years.

One day Boss sent Bob and two "bummers" 20 miles in the country to put on a big 5′ bevel gear. The shaft had been calipered by "the owner." He sent a piece of wire and said it was "just the size" of the shaft.

Bob engineered the gear into the wheel pit. He juggled it over bridge-trees, under stuff spouts (it was a paper mill) and between timbers and posts. It went on the end of the shaft all right; it slid 8″ and stuck. He turned it $\frac{1}{4}$ around, and tried again. No use; that gear would fit too soon every time. He calipered the shaft. Owner got it just right at the spot, where he measured it, but he didn't think to caliper that shaft at more than one place. Too bad! That gear has got to slide on about four feet. It is Saturday, 10 A.M., and the last train goes at 5 P.M.

Tom thinks of Dude. What would he have done? Nothing. He wouldn't have been sent if he had worked in the shop 27 years. Bob got a file and scraped away for half an hour. The gear went on 3″ further. "No use," thought Bob, "6″ per hour, means 8 hours to 4 feet, and that means 6 P.M. Can't stand that racket anyhow. Bob went to thinking. He thought easy. It came natural to him. He was always thinking about something. Dude didn't think he knew how, or have much to think with.

Bob rigged the differential chain falls to pull the gear on the shaft. Then he put his rope falls out the other way so as to pull the gear off. He put two 6″x6″ timbers between the arms of that gear, blocked up under one timber and shoved down the other. He set up one of his strikers with a bucket of water and tin dipper; the other man he rigged out with a barrel of sand. Bob started the water wheel. Mike wet the shaft, and Tom dusted on sand. Bob handled in on the chain falls. That gear walked right up to business, and came on four inches further than it had been before, then it stopped coming and began to squeal. Bob slacked up his chain falls, ran around the other side and worked the gear off again with his rope tackle.

Mike and Tom wet and sanded the shaft again. The gear came right up again, hungry as ever. It slid over that bunch and went 8″. Once Bob almost got stuck. The gear hub was hot. The shaft smoked, and the wheel almost stopped before he could draw the gear back. If it had stopped there, Tom would have been "in a box" He would have had to pull the gear off in a press.

At 12.30 P.M. the gear was up against the bridge-tree where it belonged. It was very hot and Bob couldn't bear his hand on it a second. It came awful hard the last inch. The sand had got all ground out, but Bob "thought she would come," and just got the gear in place, when it squealed and stopped.

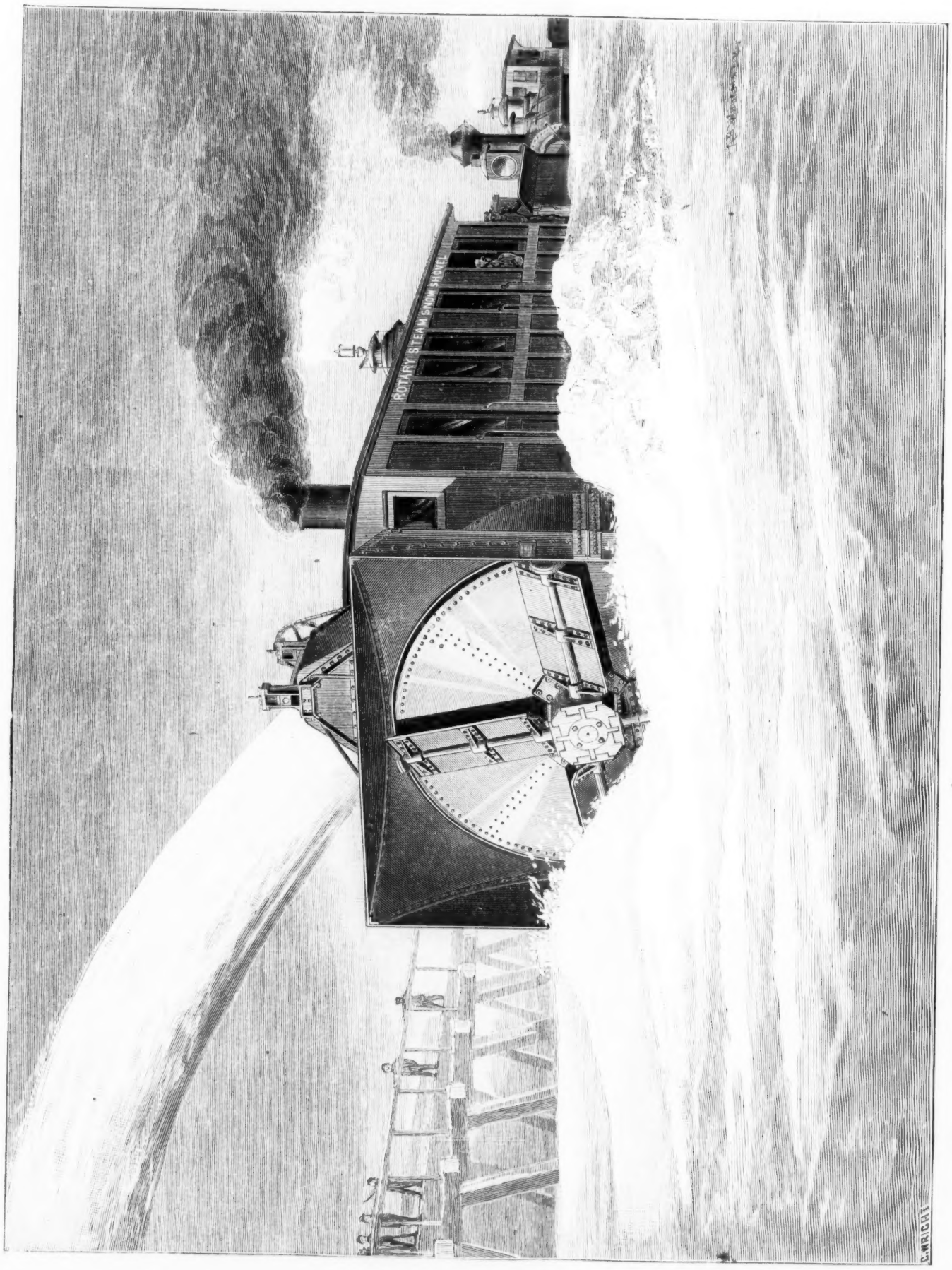
The key ways were a quarter turn off. Bob couldn't start the gear again with a jack-screw. He packed up his kit, gave the owner the key, and told him to drive it in after the gear worked loose. Bob went to town on the 1.20 train. Owner ran the mill six weeks before the gear got loose and slipped. That shaft was 4″ in diameter, and carried 120 horse-power. Bob used his brains and got out of a bad scrape in good shape.

Rotary Steam Snow Shovel at Work.

In the AMERICAN MACHINIST of September 6, 1884, we illustrated a rotary steam shovel that had been used in Canada to some extent during the previous winter. We believed that the inventor of this machine had overcome the difficulties and solved the long worked-on problem of clearing away snow obstructions by mechanical means. With a steam engine operating rotary cutters that sliced away the snowbank and conveyed it into a rapidly revolving fan that acted as a pitcher of the snow, the machine was capable of doing in a few minutes the work that would keep hundreds of hand-shovelers busy for hours. This machine proposed to effect a revolution on the usual methods of handling snow obstructions, for its designers not only intended breaking through the bank, but they aimed to throw the snow away clear of the track. This was a very important change, for the old practice of piling up the snow removed at each side of the opening led to deeper obstructions when a new storm came along.

The first machine built was defective in many respects, and the engineers connected with the company labored a great part of last season perfecting improvements. The principal change effected was that of making the machine capable of throwing the snow to either side of the track. A very strong machine was built at the Cooke Locomotive Works, Paterson, N. J., with all the improvements embodied in it. Owing to various unforeseen delays, the machine was not ready till March, and the snow blockades were nearly all raised, so there was some difficulty experienced in getting it tried. Near Buffalo there was a part of the Buffalo Creek Railroad that had been blocked with snow all winter, and there the rotary steam snow shovel was taken for trial. The test proved a particularly severe one, for the snow was badly mixed with ice, and had been traveled over by teams and pedestrians for several weeks. Part of the way it was six feet deep. Our engraving was made from an instantaneous photograph taken while the machine was at work. The stream of snow seen passing from the machine passed over a trestle work seventy-five feet from the track, and by actual measurement was found to be thrown 295 feet. A great many leading railroad men witnessed the trial, and all expressed themselves as highly pleased with the performance of the machine. The machine was pushed by a consolidation engine, and it was capable of clearing away a swath of snow ten feet wide, six feet deep, while going about ten miles an hour. The machinery received a most severe test of its strength by a log that happened to be buried in the snow bank and got caught in the knives. As the knives were not calculated to grind up lumber, they were compelled to stop when the log tried to pass through.

Power is supplied by a two-cylinder reversing engine, with cylinders 17x24 inches. The Walschaert valve motion is used. An ordinary locomotive boiler supplies the steam. After the trial at Buffalo, the machine was taken to Chicago, where it is now stored in the round house belonging to the Chicago & Atlantic Railroad Company, where persons interested in railroad matter are invited to inspect it. Machines of this type are controlled and made by the Rotary Steam Snow Shovel Company, Paterson, N. J., J. S. Leslie, President. The Western agent is Thomas Price, Lincoln, Neb.



ROTARY STEAM SNOW SHOVEL AT WORK.—(From an Instantaneous Photograph.)

The *Railway Age* says the shame of railway management is lying. Railway officers lie by equivocation, deception and downright direct lying on all conceivable occasions, necessary and unnecessary. About the most shameless and unforgivable lie they perpetrated was to lead Mr. Talbott to believe that they would pass the *Railway Age* car free over their roads, and then to charge ordinary rates for its transportation.

By a private letter from Mr. Robert E. Pettit, superintendent of the Pennsylvania Railroad, we learn that the shortened running time of the Chicago Limited Express train is obtained by accelerations of speed on the Western divisions and close regulating of the time schedule for the whole distance. There is no change made in the running time between New York and Philadelphia.

There are indications that the oil-burning locomotive is coming to the front again. We have not heard that the Holland engine is going to be fired up, but another scientist is calling for the means of enabling him to demonstrate that oil can be burned more cheaply than coal. Lest the last experiments in this line may have escaped the attention of the latest investigator, we would direct attention to the Holland locomotive, which is stored away in some obscure round-house, and may be bought cheap. Russian engineers have demonstrated that petroleum products may be used successfully in locomotives, but in the regions where they burn oil coal is not so easily obtained as it is in the United States.

The Pennsylvania Railroad Company has introduced a new and very accommodating feature on the limited trains. The conductor on each of these trains is supplied with a large package of envelopes, each one of which is weighted with lead, so that they may be tossed from a moving train to a station agent by passengers who wish to forward telegrams before the train reaches its next stopping place. On the envelope are printed directions for the telegraph operator to forward the dispatch at once.

In these days of recurring reports of wages reduction it is pleasant to announce that a move in the opposite direction has been made by a large corporation. For several years the locomotive engineers of the Cincinnati, New Orleans & Texas Railroad have been paid lower wages than engineers doing the same kind of work were receiving on other roads. The depressed financial condition of the company induced the men to work on at low rates in hopes that better times would come when the prospects of the company improved. The season of travel to the South during the late winter has brought heavy business to the road, and the officers have decided to raise the pay of the engineers to the level of other neighboring railroads.

New Planer and Matcher.

This machine is one recently put in the market by the N. O. Nelson Manufacturing Company, St. Louis, Mo. It is adapted to the uses of small manufactures and medium-sized shops, where it is required to do a variety of work with few machines.

The machine will plane 10 inches in thickness and 24 inches wide, and will match up to 12 inches in width. The rolls are wrought iron, 4½ inches diameter; the machine will work at a speed of from 40 to 60 feet per minute on yellow pine flooring.

An ingenious arrangement provides for dropping the matcher-heads beneath the bed at a single movement, converting the machine into an ordinary surfacer. It is adapted to the use of "rustic" siding knives, beader-bit, and other modern appliances.

Accident on the New York Elevated Railroad.

Owing to the rapidly increasing traffic on the elevated railroads of New York city, the management have found it necessary to run the trains on the Second Avenue line down to South Ferry, which considerably increases the number of trains on the lower portion of the Third Avenue road. On the second morning after the change, the trains passed upon this part of the road quicker than they could be switched off, and several trains were stopped between stations. This is no unusual circumstance, and it would have passed without notice had the wrong man not been in charge of one of the engines. He came round a curve and blundered into the hind end of a stationary train, making a bad smash and fatally injuring his fireman. The man evidently was paying no attention to his business in the first place, and when he saw a collision probable, he lost his head, and whistled "down brakes," instead of applying his brakes promptly, reversing his engine and opening the sand valves.

All American railroads are operated safely, principally through the unsleeping vigilance and constant care of locomotive engineers, and railroads chronically crowded, as is the case with the elevated railroads of New York, are peculiarly dependent upon the attention of this class of employees. When a man whom nature intended for a preacher, or some occupation that does not require promptitude in meeting emergencies, is found in charge of a locomotive on these roads, he will cause trouble sooner or later.

The daily papers of New York, with one accord, found the general manager responsible for the accident, and most of the reporters favored Col. Hain with directions about operating the elevated railroads. Perhaps the general manager is to blame for not consulting daily about his work with the men who talk about the scalding steam that passes through the train air-pipes, and commend the engineer for promptly whistling "down brakes," but we prefer to risk our life and limb, with the experienced railroad man who is struggling to move more trains on those roads than they ever were calculated to accommodate.

Measurement vs. Guess-Work.

By S. W. Goodyear.

I was requested recently to state how nearly I thought it was possible to determine size and length, or to distinguish slight differences, between different pieces, as, for instance, the difference in size and length of needles, rivets or pieces of wire, which were intended to be the same, without actual measurement, but by the sense of touch or vision alone. The assumption of the question was that by careful training and much practice the acuteness of touch and accuracy of eyesight might be developed to that extent that by sense of feeling, or ocular inspection, positive conclusions might be arrived at in matters of size, length and shape. I replied that, "while I recognized the marvelous approach to accuracy attained by long practice in ocular or thumb and finger inspection, my training as a mechanic led me to call it, after all, guess-work."

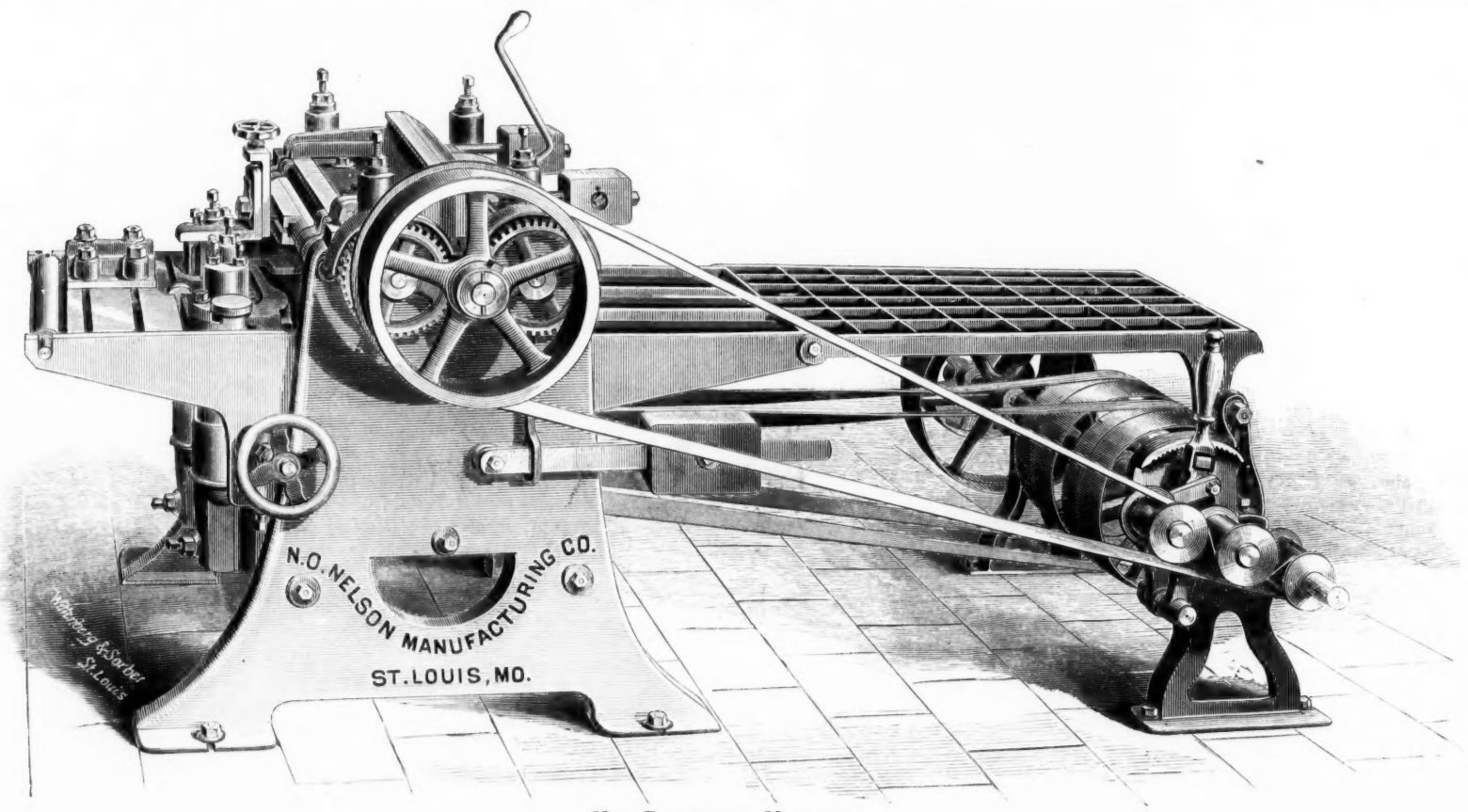
I have not, on further reflection, altered my opinion; but there have been, and there are, constantly occurring such notable instances of accuracy of judgment, unaided by mechanical appliances, as to raise the question whether the word "guess" should have a place in speaking of these substitutes for measuring, any more than in speaking of what is called "actual measurement," but which is known by those who measure the most closely to fall short of exact truth.

It is an easy matter to provoke a laugh at the expense of the man who measures the width of a door by stretching his hands apart till the finger tips on either hand exactly reach the extreme edge, and, then walking away, says, "Don't get in my way; I've got the width of a door here." Much the same may be thought of the man who uses thumb and finger to get the size of a shaft, or to determine if it is round, or who with thumb and finger twirls a piece of wire between his teeth, and decides whether it is round. These are plain subjects for actual measurement, but there are many other tests, as in the assorting of wool or other fiber, the inspection of bank notes for detection of counterfeits, the inspection of fracture in metals to determine structure, quality and condition, comparison of shapes not easily gauged or measured, in which accuracy of judgment is acquired which is truly wonderful. Is it not, however, guess-work? It certainly is not infallible, as would be proven by actual measurement in any case where the measuring test could be applied. However accurate the decision of the most expert, there would always be room for doubt; and who believes that in such cases as may be put to a subsequent test by actual measurement any thumb and finger and ocular inspection will determine upon the uniformity of size and shape, with a certainty which will not leave very wide differences to be discovered through the use of improved appliances with which to measure, aided by a powerful magnifying lens?

That in habitually handling wires of small size the sense of touch will become so acute as to detect—as between different pieces of a mixed lot—variations of one thousandth of an inch, in cases where that variation would be but one per cent. of the entire diameter, is true; but, while this might be done without a miss in some cases, it would not be conclusive. To follow with actual measurement would be considered necessary, and within a narrow range of tests it would be found that the man who could by feeling guess just right often failed.

But how about actual measurement? What is it but guess-work, aided by mechanical appliances and scientific methods? The skillful machinist with calipers measures the hole to which he is to fit a shaft, and, transferring the measurement from inside calipers to outside ones, proceeds to turn the shaft to fit. Watch him as he, by repeated trials, adjusts the inside calipers to the hole, and again the outside ones to the size so carefully taken, and finally the extreme care with which he decides, when the relation between the bearing points of his outside calipers on the turned shaft shall be such to the bearing of inside caliper points within the hole, and within the points of outside calipers, as to let the shaft, when removed from the lathe, just slip into the hole, or be just a driving fit, according to which was aimed at! How is it done? Senses of feeling and seeing, aided by the calipers, which, by repeating the feelings and ocular observations to determine just when the points of contact between caliper points and inside of hole and outside of shaft are on a line at right angles to the axis, and the contact so slight that—pshaw! I can't compare my touch with anything else, and, of course, I don't know how it compares with that of anybody else, and perhaps that of no two men is exactly alike; but sizes are arrived at and fits made through touches so gentle that none but the men who make them could feel them at all, and from that by a steady gradation up to where calipers spring, in being pushed in, or over, with a force that would grate as harshly on the nerves of the sensitive-touch workman as a rap on the knuckles. He could make no fits that way! He don't see how anybody can! But they do. He guesses when his calipers go in and over with no pressure and still just hit. They guess how much the pressure is on both measurements. It is guess work.

Even in the most accurate measurements, by the most scientific methods, as well as by the use of calipers, but through the agency of measuring instruments and magnifying glasses the judgment based on feeling and seeing is under constant surveillance, and within limits which no simple thumb and finger test can approach, is being constantly verified. From the pen of Mr. Bond, of the Pratt & Whitney Company, of Hartford, Conn., has been published much extremely interesting matter in relation to the wonderfully close measurements made in his department of this justly celebrated machinery manufacturing establishment, but I doubt if he could in any pen picture—I certainly cannot—describe the extreme solicitude manifested on his countenance, and in his voice and manner, of which I was one day the witness, when Mr. Pratt unthinkingly essayed to wipe on his sleeve a little standard measurement cube of steel which he held between his thumb and finger. Quick as thought his hand and voice were interposed to prevent the diminution of size which he appeared to believe would result from even a single rub on a piece of clean cloth. Does some reader feel like sneering at the scanty ground of alarm? To Mr. Bond the danger seemed a reality, and the little cube of steel, on being returned to him, was handled more carefully and deposited in its velvet-lined case with more care than would have been the case had it been the most costly jewel. Why? It was a test piece. For what? To refer to in verification of measurements made. But, don't this wonderful measuring instrument, this machine with its massive base bedded firm as a rock on its foundation, with its machinery through which the sense of touch is refined down to the utmost delicacy of which the imagination even has any conception, and its system of microscopical aids to the eye of the most perfect character which in-



New Planer and Matcher.

genuity can suggest or science provide, measure correctly? Yes; it splits a thousandth of an inch up into such infinitesimal fractions as would bewilder the close workman of the caliper-measuring genus if he were asked to divide the inch accurately into as many parts. It measures and guarantees within the one-twenty-five-thousandth part of an inch, and detects differences, possibly, of one-millionth of an inch! Still, there must be even here ground for doubt, hence the test pieces to be preserved and guarded with such almost worshipful care. Is not even this guess work, too? Is not all so-called perfection in measurement after all only comparative?

The wonderful accuracy with which some blacksmiths estimate the amount of material of any given size and shape to produce a forging of some other size and shape, and the precision with which they forge to exact size, and leave things which are designed to square, "perfect," is justly deemed wonderful, and is duly admired and appreciated, but what is exact in this connection? Well, that depends upon what the thing is. All the way from $\frac{1}{32}$" to $\frac{1}{8}$" "off" will do.

I once had the pleasure of accompanying a very appreciative lady and gentleman through a steel works, with the workmen of which and their capacities I was somewhat familiar, and as we stopped to admire the skill of the tilter, whose duty it was to draw from the billet the small sizes of square and octagon steel with a quick running steam hammer, I remarked that the eye and judgment of this man were so correct, that when he stopped hammering the bar to try the size with his gauge, it hardly ever failed to fit. He did not "cut and try," but hammered right to the size and then tried it. Passing on with the gentleman to some other point of interest I soon discovered that the lady had been left behind; she soon joined us, saying, "I waited to see that man try the gauge on the bar he was drawing." "Did it fit?" I asked. "It did," was the reply. Wonderful? Yes, and still I have a piece of octagon steel less than a foot in length which this man gave me as a sample of his best work to be compared with some which had been swaged in a machine with positive motions, and which did not vary in size in the length of a bar, or as between one bar and another so much as one thousandth of an inch, while his sample piece varied in size at different points in its short length fully one hundredth of an inch, and was nearly "that much off" from the size for which it was intended at its nearest point. All guess work, same in kind, but different in degree, and in all the different ways in which measurement, or gauging, with their substitutes are arrived at, whether by the most primitive, or by modern and scientific methods, there are the variations which each operator will inevitably make, and greater still, the variations between results in the same methods practiced by different operators.

Not perfection, or, if perfection should be gained under the most rigid inspection, would there still not remain ground for doubt as to the entire and uniform accuracy of the most careful measurements by the best of methods? If these are facts, ought not lessons for the young to point in the direction of actual measurement—the best available—with a wholesome regard for the truth in speaking of absolute accuracy even then, rather than to teach that unaided, the sense of touch, and sight, can determine beyond a possibility of mistake?

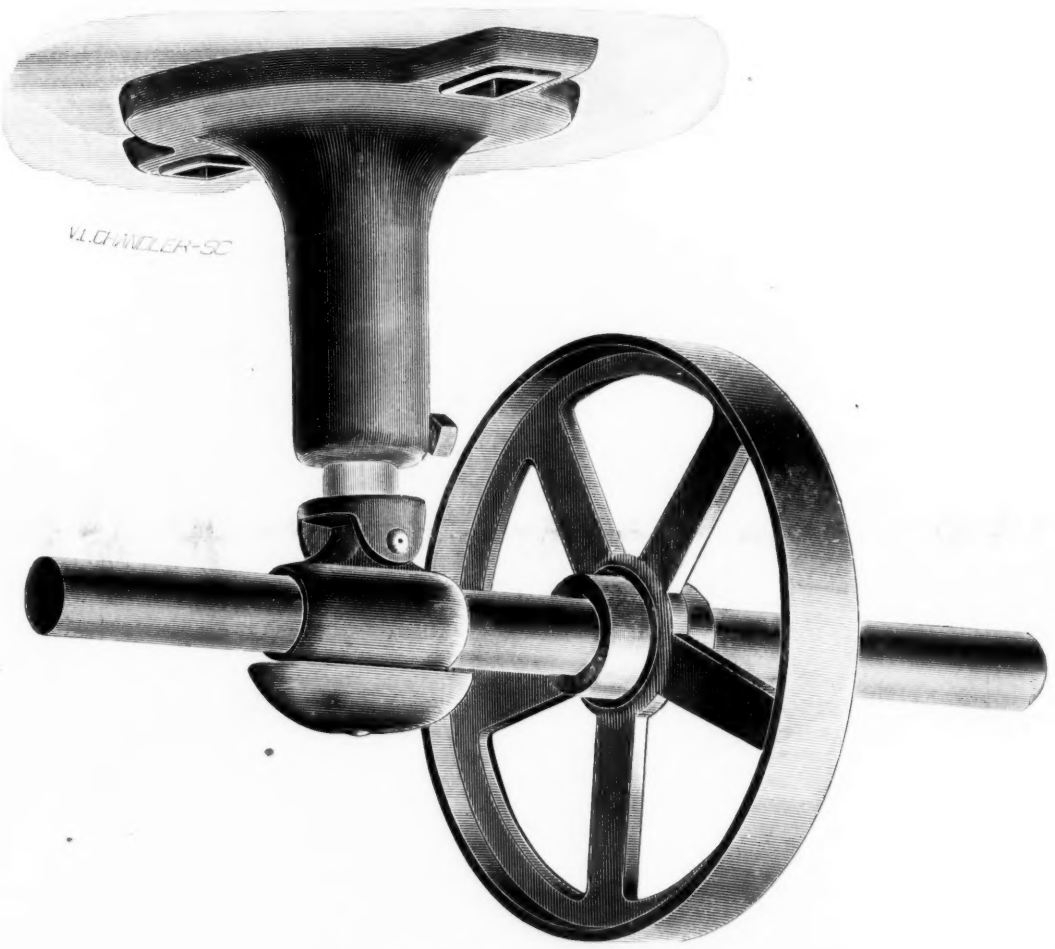
It may be very well to admire those giants among workmen who seem to know intuitively just how deep to set a tool to cut exactly the size wanted the first time trying, who know at the first time trying whether their calipers are set just right, and are never seen going back to feel a second or third time to see if their later judgment confirms their first opinion; no hesitation; no doubt; no mistakes. Who dares say that of the best of them? Even if this sort of workmen were as accurate as their admirers would have us believe, they are not plenty enough so but that the men who feel, and feel, and still show some signs of misgiving as to the accuracy of their measurements till putting their work together "settles it," will still be called upon to do the bulk of the close work, and is it too much to say really the closest work? Sticking a pin, or the point of a knife, in the base board in the exact spot to measure the height of a plug hat, taking a handful of beans from a barrel, or coins from the pocket, or nails from a keg which shall prove on counting to be the exact number intended may be a very desirable accomplishment. To be able to distinguish coins of different denominations, or to read by the sense of feeling, are desirable to the blind, but is there any use in teaching that their sense of feeling may be educated to be more accurate than the sight of those who have good eyes?

Perhaps I have said enough on this subject. Perhaps some of your readers, who believe that irregularities of shape can be detected by twirling a piece of wire between the teeth, or between thumb and finger, which would pass unchallenged by test between the thumb and finger of steel measuring instruments, will tell us what they know about it, and in that way the man who came to me for what I could not give him will get the desired information. Of course, he reads the AMERICAN MACHINIST; or, if he don't, he should.

I have recently seen a specimen of thread-cutting on steel which struck me as a very wonderful illustration of what may be done with first-class tools, and a description of which may be interesting to those who believe that in cutting a V-thread it is necessary to rough down to nearly a finish with a round-nosed tool, and finish with a sharp pointed one, on the ground that a sharp point cannot be retained to do the whole job. The cutting to which I refer was 7 to the inch, sharp V-thread on $1\frac{1}{16}$" steel screws $2\frac{1}{2}$" long, cut close up to a shoulder. Seven of these screws were cut entire, to a finish, without grinding the tool, after which the tool was used without grinding to do some other cutting, and was then in good condition to do good work. The amount of work done in addition to the seven screws I don't remember, but the tool not yet ground hardly showed signs of having been used.

The greatest difficulties encountered by many machinists are in turning, planing, milling, or otherwise cutting steel. Much of the trouble arises from improper annealing, and the use of tools of third or fourth-rate quality. Pieces of steel are condemned as too hard to be cut or as full of hard spots, the rough cinder-coated scale on which resists the action of the best tools, when, if the same pieces had been heated slowly and evenly—only to a red heat not hot enough to raise the scale—and properly cooled off, not by burying in cold ashes, which give a chill almost like plunging in cold water, they could be cut with good tools as readily as the softest iron. Tool steel is condemned because the tools made from it do not stand, which, if worked and hardened at a lower heat, would furnish tools not to be beaten.

No matter who says, "Heat steel as hot as it will bear and work it while hot," don't. When told to heat steel up to a good yellow heat for hardening, if the steel is suitable for first-class tools, don't. When asked to believe that tempering restores the fineness of grain which, by hardening at too great heat, has been lost, don't. When asked to believe that restoring burnt steel depends upon the use of some restoring compound, don't. Don't harden a thread tool, or any other for use in a lathe or planer, at a heat which will not leave the steel stronger for the hardening, instead of weaker and more brittle, and finer instead of coarser. Don't say this can't be done. Don't place much dependence on tempering, unless the hardening is known to have been at the right heat.



SMALL HANGER AND PULLEY.

Small Hangers and Pulleys.

This line of light goods will be appreciated by amateurs, jewelers, and all who use light power, from foot power, water motors, electric motors, etc.

The shafting is all of one inch diameter, with the hangers and pulleys to match. The hangers will swing a 16-inch pulley, are adjustable, have solid reamed boxes, and are amply strong enough for the service intended.

The pulleys are for either one inch or one and a-half inch belt, as desired.

They are manufactured by Geo. B. Grant, 66 Beverly Street, Boston, Mass., for the convenience of his water-motor trade, but are, of course, useful in many other connections.

LETTERS FROM PRACTICAL MEN.

Casting Rolls With a Shaft in Them.

Editor American Machinist:

In "Questions and Answers" (AMERICAN MACHINIST, Dec. 20, 1884) F. H. V. writes: "We use a large number of rolls 14" long and 8" dia. cast hollow with 3" metal at each end. We bore out the ends for a 2" shaft, and force the shaft into the roll. Is there any way by which these shafts can be cast in the rolls and be solid?"

This question, from the superintendent of a machine works in New York State, I learn from that gentleman, is an important one. Mr. Jewett's suggestion in answer to the above is a good one, but in the average shops throughout the country it is not always convenient to prepare work of this kind in the way he mentions.

The superintendent referred to favored your correspondent with a visit a short time ago, and in conversing with the gentleman he stated: "We have not been able to find a way to cast this style of roll, and have it perfectly solid and *free from vibration*." I found, on questioning, they had tried squaring that part of the shaft which goes in the mould, wedging, fulling, counter-sinking, and most every way known. We suggested cutting a coarse thread on that portion of the shaft exposed to the iron and painting with red lead mixed with turpentine. He remarked, "that is a new idea to me."

The thread-cutting process has been practiced to some extent, yet I believe it will be "a new idea" to many. It is the most satisfactory method we have ever practiced to secure wrought iron arms, shafts or braces in castings. It is the only way we have found to securely fasten the arms in the steel wheels mentioned in my last article. We also find it to be as economical as any plan we have tried.

In making a balance wheel 6 feet in diameter with $1\frac{1}{2}$" wrought iron arms, arms to set 4" into the casting, we cut a coarse thread $3\frac{1}{2}$" long, and paint with red lead mixed with turpentine. We make a large number of small castings for the cotton factories here, weighing $\frac{1}{2}$ pound each with a $\frac{1}{4}$" round iron rod set in them $\frac{3}{4}$". We cut a thread $\frac{5}{8}$" long on these rods and dip the end in the paint pot, and set them as fast as the moulds are ready for them. They are required to be firm and strong in the casting. In preparing moulds for castings as light as these, or up to a few pounds' weight, we put some heavier pattern in the flask and gate into the small castings direct, from them into the heavier casting. The iron fills the small moulds first and flows through them into the mould beyond. It will be noticed we do not cut the thread quite as long on the rod as the length it goes into the casting. Care should be taken to cut the thread the proper length; if it extends beyond the casting it makes the rod weak at that point. Wrought iron rods, or bars of any shape other than round, we put into the tumbling mill until they are clean and bright, then nick them here and there with a chisel and paint them.

We make rolls 6" diameter, 12" long, with a $1\frac{1}{2}$" shaft cast in them. We have moulded and cast these rolls in perpendicular and horizontal positions, and gated them in various ways, and find by cutting a coarse thread about 4" long in the center of the shaft, painting the shaft the whole length of the casting, moulding the roll in a horizontal position and setting the pouring gate in

the center of the roll directly over the shaft, we have as a result a roll that is cast solid, and one that is firm and rigid on the shaft, and we flow only enough iron through to fill the riser.

The roll "F. H. V" refers to is cast with a recess core in it. I doubt very much if a roll can be cast in that manner and be free from vibration or stand up to the work required of wood-working machinery as a solid roll would do, if the extra weight of iron to cast the roll solid is no objection. I believe it would be fully as economical to use that amount of iron as it is to pay for the time, material and fuel to make and dry the cores, and the moulder's time in setting them, and the percentage of losses therefrom. Add to this the expense in the machine shop to bore the roll and fit the shaft in, and at the present price of iron I believe the cost of production in rolls of that size would be in favor of the solid roll.

ROBERT E. MASTERS.

Columbus, Ga.

Slipping of Locomotive Wheels.

Editor American Machinist:

In your issue of 14th of March, a question is asked in connection with locomotive wheels, but the answer given is not correct. The inside wheel does not slip, as the wheels are portions of a cone, not of a cylinder. The flanges of the wheels do not fit close to the rails, a little play being allowed. When running in a straight line, the motion compels the wheels to keep a position in which both are of equal diameter. When moving in a curve they shift slightly to the outside of the curve, thereby diminishing the diameter of the inside wheel and increasing that of the outside wheel. The motion compels them to accommodate themselves to the proper diameter for straight lines or curves of whatever radius.

WM. M. ROBERTSON.

GLASGOW, Scotland, April 8, 1885.

[Our Glasgow correspondent gives the correct hypothetical description of the action of locomotive wheels in moving round a curve, but we answered the question according to our knowledge of the actual operation. The theory of coned wheels preventing the necessity for one wheel slipping is pretty, but in actual practice few wheels retain the coned shape that will enable both to roll round a curve. We advise our correspondents who doubt the correctness of our position in this matter, to practice in pushing a pair of large wheels round a curve.]

Uniformity in Gearing Desirable.

Editor American Machinist:

Will not the makers of cut gearing, who wish to have the diametral pitch system become a universal standard, make an effort to establish a rule for the working depth of tooth, the portion of tooth above and below pitch line, and thickness of tooth and thread in worm gearing? Nearly every mechanic who has much to do with gears, understands diametral and circumferential pitch; but ask a man to give the outside diameter of a worm wheel, from the pitch, and number of teeth, and the chances are that he will give it up. Opinions differ. If some of the leading establishments who are making and using worm gearing, will give their rules, it would be of use. Doubtless, lesser lights would be glad to follow the lead of a good practical authority, thereby establishing some degree of uniformity in the practice.

To illustrate: I wish to use a worm and gear in a certain machine. I turn up the blanks, and, not having conveniences for cutting teeth on the wheel, I send the blanks to A, who has such conveniences. At the start, I lay out the work in a manner which I know from experience will work well; but I would feel greater certainty of getting a good job from A, if my lay-out conforms to his rules.

Splitting hairs over points of theory will not help the matter. What is needed, is the general adoption of a rule which has been found to give good results.

Will the Pratt & Whitney Co. be so kind as to give the rank and file the benefit of their experience and practice in this particular?

GORDON.

Steam Engine Practice in the Islands of Hawaii.

Editor American Machinist:

I have been a reader of the AMERICAN MACHINIST since its first issue, and have always taken great interest in the indicator diagrams shown from time to time. I enclose herewith copies of some diagrams I have myself taken from different engines on these islands of Hawaii; from these you can judge of the economy of engines yet in use in some of the sugar mills here.

Honolulu, H. I. CAPT E. L. ROBBINS.

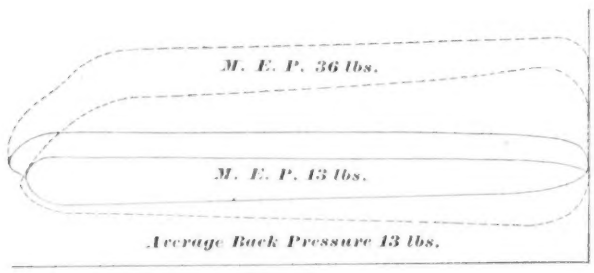


Fig. 1

Slide Valve Throttling Engine, 12"×42", 46 Revolutions Per Minute. Boiler Pr. 65 lbs. Highest Initial Pr. 60 lbs.

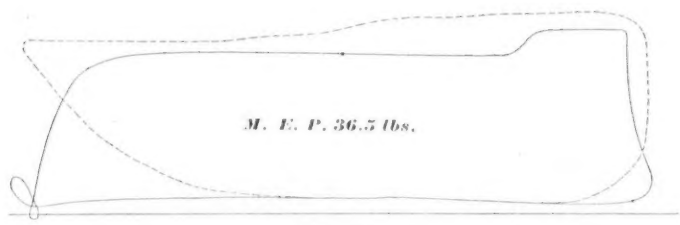


Fig. 2

Glasgow Slide Valve Engine, 14"×36", 40 Revolutions. Boiler Pr. 65 lbs. Highest initial Pr. 54 lbs.

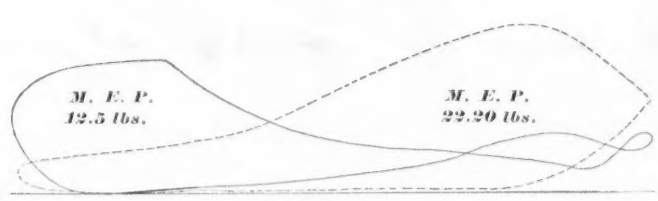


Fig. 3

Newburg Poppet Valve Automatic Engine, 18"×36", 62 Revolutions. Boiler Pr. 70 lbs. Highest Initial Pr. 45 lbs.

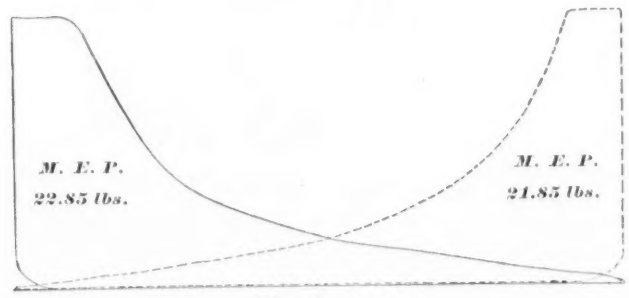


Fig. 4

Corliss Engine, 18"×36", 66 Revolutions. Boiler Pr. 80 lbs. Initial Pr. 73 lbs. This Engine was Put in Place of the Newburg Engine; Saving in Fuel, $27 Per Day.

Melting Steel.

Editor American Machinist:

Referring to Mr. Masters' article on melting steel, I have several times melted steel in an ordinary cupola with good results. I have melted rail buts and put the metal into bull pinions, but they required annealing, and were full of blow holes. They worked satisfactorily, however. We had a lot of about 300 tons of old car wheels; among the lot were some steel tired wheels—that is, they were cast with steel tires. I broke them up, and took the tires, about one-half steel and one-half No. 2 charcoal iron, and run it into pinions that would weigh from 50 to 100 pounds. The metal as it left the furnace was very hot, but it would bung a ladle up very quickly. The castings were hard and brittle, but when annealed it was not possible to break them. You could bend the teeth, or hammer them down, but they would not break. They were more ductile than wrought iron.

I have used steel in chilled rolls, but not with good results. It would not mix well with the iron.

FOUNDRYMAN.

Weight on Locomotive Drivers.

Editor American Machinist:

I notice a criticism, in the *American Journal of Railway Appliances*, of a recent communication of mine in your paper, on weight on drivers.

The criticism appears to be mere assertions and devoid of facts.

I was once connected with a road as general foreman of machine shops, which replaced its engines, having 10,000 lbs. per driver, with others of 16,000 lbs. per driver, the former being sent to other divisions with fewer grades. I observed after a year's use of the heavier engines, that the tires, tread and flange, showed much less wear than the lighter engines had. The road master's report showed that the track suffered much less under the heavier engines than the light ones.

The writer of the criticism has evidently never had any practical experience as a locomotive engineer, as he leads his readers to believe that a wet rail is conducive to slipping.

Every practical engineer is well aware of the fact that the rails are in much better shape to pull a heavy load on during or just after a heavy rain, than before. In fact the entire criticism shows a second-hand knowledge of practice.

Practical men are aware of the fact, that when an engine can slip her wheels easily, she is hard to keep up, expensive in fuel and unsatisfactory generally. The writer of the criticism proposes to increase the cylinder's size, with the intention, evidently, of gaining a greater degree of expansion at short points of cut-off. Theoretically, this may be in the right direction, but practically, it would result in an increase of expense in keeping up the engines.

As a matter of fact, an engine should have as much weight on the drivers as will prevent her from slipping at full stroke, as without it she is nearly as liable to slip when cut off close as at full stroke.

Referring to practice again: When an engine is running, hooked up close, and commences slipping, an engineer usually cases off the throttle and drops the lever down a few notches. The result is, of course, less theoretical economy, because less expansion and a lower initial pressure is the result, but giving a much less varying pressure on the pistons, when the slipping at once disappears.

The writer of the criticism would increase the diameter of the cylinder and obtain better economy by working the engine close at all times, evidently. This, as shown, would result in an increase of expense in keeping up the engine, if not in an actual loss of economy, because the high initial pressure would cause slipping at short points of cut-off, unless the weight was on the wheels to prevent this; the engineer would practice his choicest vocabulary of cuss words, ease the throttle off and drop the lever down a few notches. My criticiser may improve his valve motion to his own satisfaction, but unless he also increases the weight on the drivers sufficiently to prevent slipping at full stroke, he will have slipping, wear of tires, racking of engine, etc., at short points of cut-off, and the engineer, unless constantly under some one's eye, will defeat his improved valve motion by introducing wire drawing at the throttle with longer points of cut-off. But if *forced* to run his improved engine close, the expense of turning off tires and putting in new crank pins will far outweigh the claimed economy of water and fuel.

My criticiser evidently assumes that that which leads to economy in an automatic stationary engine, would also act as kindly on a locomotive. He deals with the cylinder theoretically, but does not go back of this either theoretically or practically. Other mechanical engineers have run into the same error, and will continue to until they handle the indicator less and the throttle more.

FRANK C. SMITH.

Traction Increasers.

Editor American Machinist:

As a subscriber to your paper, and a young locomotive engineer desiring to keep up with the times, I can't help protesting against the tone of your recent editorial on traction increasers. Having witnessed tests made on two occasions with the device, and having an intelligent idea of all points relating to the tests, I have not found anything about it to call for such unreasonable condemnation.

Your article in issue of March 21, concerning claims of engine 10, was all right, for the engine carried greater pressure than 140 pounds.

An extra skillful engineer may do as good work with a heavy engine as the same weight engine with a device would do with an engineer not so skillful; but our extra skillful will sweat more and have nerves strung to higher tension doing it. The device is certainly a godsend to the "viciously designed" locomotive, and might not prove a luxury to an engine of perfect design.

Why is it not reasonable to imagine a light weight engine, beneficial to track where heavy trains cannot be hauled on account of frequently occurring grades, running with device released? And how dangerous is it to apply a traction increaser on a grade at a rate of speed usually considered safe for hand cars?

If you ever managed a locomotive with a desire to do your duty, I think you may have thought that anything in the way of a device to lessen the strain on your nerves, on a misty night with "bad rail," a blessing, to relieve you from spreading yourself over throttle lever, sand lever, and the lever of misery stirring your "innards" like a witch's cauldron, at the prospects of stalling.

I am ready to admit that probably the author of the viciously designed locomotive ought to be hung; but I am not ready to admit that an invention coming to relieve the blunder should be condemned without giving a good reason for it.

If I am in error in my way of thinking, Frank C. Smith was on false ground in a back number of the paper.

I don't expect to take any stock in the Locomotive Improvement Company, but I like to read the AMERICAN MACHINIST, and generally find reasonable articles therein.

J. E. PHELAN.

[Our correspondent mistakes the aim and intention of the article he criticises, which was written in the interest of sound designing of locomotives rather than in condemning devices intended to rectify mistakes. The crucial test of experience has demonstrated that building locomotives deficient in adhesion, and depending on means of transferring part of the weight of the tender upon the engine, works unsatisfactorily.]

A Remedy for Electricity in Saw Table.

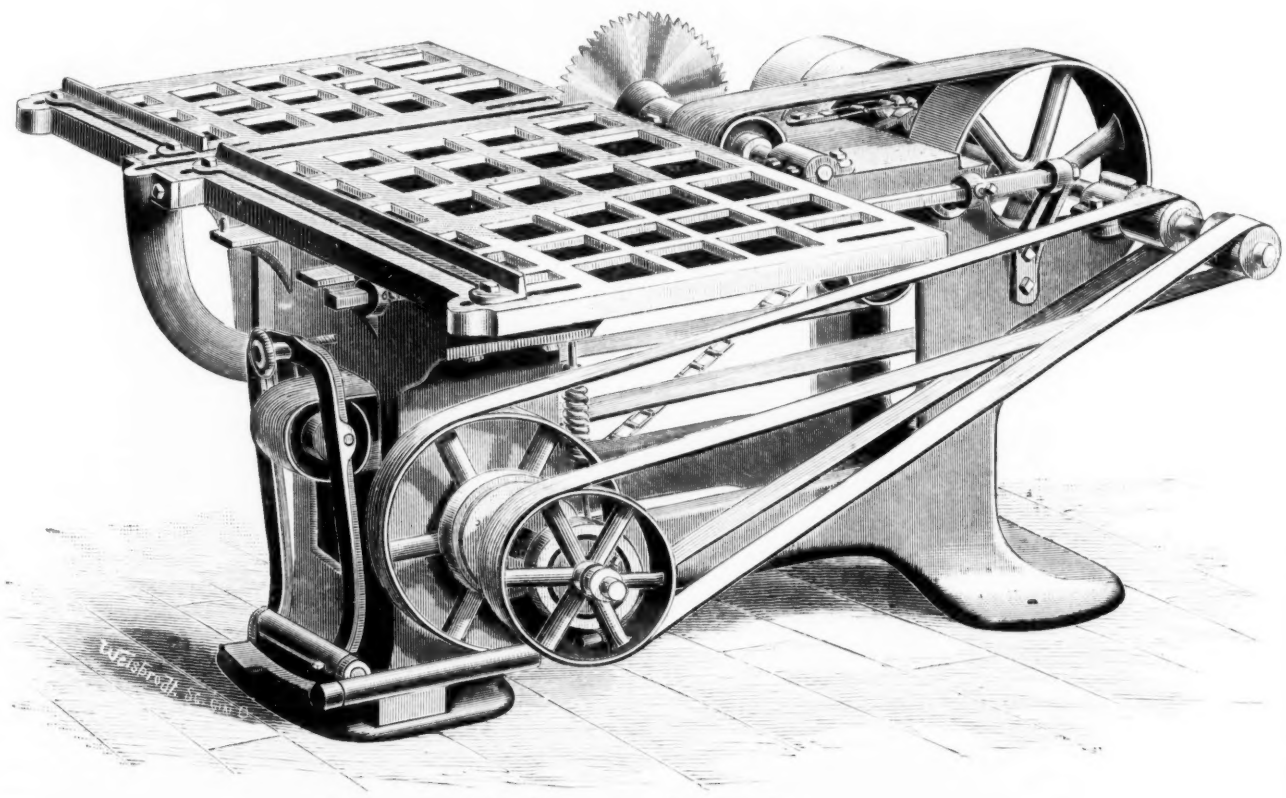
Editor American Machinist:

Electrical manifestations, similar to those mentioned by "H. W.," in your April 18 issue, have occurred in a double iron saw frame, and also in an iron planer, located in our pattern shop. Enough electricity is generated to enable a person to light a gas jet just above the frame, placing one hand on the frame, and bringing the finger of the other hand near the jet, the gas being turned on. This has been done many times.

I suppose the electricity is generated by the high speed of the saw or belts, after the manner of the Holtz electrical machine.

The annoyance to workmen can be prevented by attaching a wire to the frame, and connecting with the gas or water pipes.

D. C. WILLIAMS.
Johnstone, Pa.



NEW SELF-FEEDING CROSS-CUT SAW.

How to Get Rid of Electricity in Machines.

Editor American Machinist:

Last January, the saws, planers, etc., in the pattern-room became heavily charged with electricity, which at times developed great intensity, and rendered working the machines quite unpleasant, if not dangerous. The pattern-room is in the second story, and as live steam is used for heating, the floor was dry as tinder, insulating the machines as completely as if they stood on a glass plate.

The frictional electricity from the belts charged the machines so heavily, that sparks one half inch long could be obtained by presenting the knuckle.

To overcome the difficulty, a small wire was driven into a crack in the floor and connected to each of the machines, and to the water pipes, thus allowing the electricity to pass off gradually without acquiring intensity. This plan was perfectly successful, and can be applied in a few minutes.

C. M. CONRADSON.
Fuller & Johnson Manufacturing Company (Limited).
Madison, Wis.

Hydraulic Propulsion.

The *Mechanical World* has an account of a trial in France of a vessel in which hydraulic propulsion was employed, and which appears to have been more satisfactory than any previous attempts in this direction. The suction was through a pipe opening forward, presumably so that it would be aided by the motion of the vessel through the water, and the delivery through a conical pipe at the stern, ending in a mouth-piece. There were two side pipes near the stern, which were used for turning around quickly, and two pipes leading out through the sides at a sharp angle forward for backing. A total efficiency of 49 per cent. was reached, which, our contemporary adds, is about what is assumed for screw propulsion.

Considerable attention was given at one time in this country to hydraulic propulsion of steam vessels, but no very decided success was reached. If, as our contemporary believes they will, the French Admiralty make a comparative test of the system on two gunboats, it will be watched with a good deal of interest, as there is, under some circumstances, a good deal to be said in favor of hydraulic propulsion. To make it economical, steam must, of course, be used more economically than in the ordinary full-stroke steam pump. In the experiment referred to, the pump was driven by an inverted cylinder steam engine, probably designed to use steam with good economy.

New Self-Feeding Cross-Cut Saw.

The frame of this machine is cast whole, cored out to lighten. The slides on which the mandrel moves are cast on the frame, making a solid and durable bearing for the yoke, which carries the saw.

The mandrel is provided with self-oiling boxes, lined with babbitt metal. It is fitted with expansion device, by means of which saws with different-sized holes may be used, running true.

The stroke of the saw can be instantly altered between 1 inch and 31 inches. The feed is by friction, which is self-releasing at the end of the stroke, the return motion being rapid.

The manner of belting provides for the use of a tightener, so an endless belt can be used, and any stretch taken up.

The table, of iron, is strongly ribbed and braced. It rests on two brackets cast on each side of the machine. The machine is furnished without iron table, when desired.

The fence is adjustable, and can be used on either the front or back of the table.

Boiler Feeding Appliances.

A somewhat interesting paper was recently read before an English mechanical meeting, on the "Past and Present Methods of Supplying Steam Boilers with Water." The author of the paper had made considerable research into the earliest methods of boiler feeding, and found that Thomas Savery was the first to describe a system of feeding boilers after steam was raised. He first filled the boiler at the manhole, but after the boiler got hot it was fed from a stand-pipe with a column of water high enough to force the water against the steam by gravitation. As the steam used in boilers during the 18th century was of very low tension, it did not take a high column of water to overcome the pressure. The first use of a pump connected with a steam boiler was to pump the water from the hot well to the column pipe, so that partly heated feed-water might be used. This was also the first case of heating feed-water, and was applied by Smeaton. When force pumps became necessary, on account of the increase in the boiler pressure, which has been the invariable accompaniment of improvement and economy in the use of steam, the simple ram plunger was frequently employed, the suction and delivery being arranged by means of inlet and outlet valves in the casing or body of the pump. This arrangement, known as the plunger or force pump, was invented by Sir Samuel Morland in 1675. This invention has an additional interest in being associated with the first application of the gland stuffing box. The still older arrangement of having the delivery valve fixed in the plunger was also very common. In course of time the arrangements of the engine-rooms and boiler-houses of large establishments were put upon a more independent footing in relation to each other. In the earlier practice the steam boiler is generally found in close proximity to the engine, and, in most cases, one man was no doubt all that was necessary for attending to both. But where several boilers were constructed in a building set apart for the purpose, and in situations where the dust of the stokehole was not allowed to reach the engine-room, and a certain amount of separation was provided on this account, it became advantageous that the man in charge of the boilers should be provided with an independent means of feeding them. There was also a disadvantage in being dependent upon some moving part of the engine as the means of working the feed pumps, especially in the case of industries where steam was employed for other purposes than the supply of motive power. In these cases a feed pump worked from the main engine; if its dimensions were calculated for nothing more than supplying the boiler with the equivalent of water evaporated in the production of steam for the use of the engine only, it would prove insufficient, and at the best it was a cumbrous method of feeding a boiler, especially when the engine was a large one. These considerations give rise to a demand for a small independent pumping engine, which has since become universally introduced. Then came numerous improvements on the steam pump, and afterwards the injector. In a discussion that followed the reading of the paper, most of those taking part spoke of the exhaust steam injectors as the most economical method of boiler feeding.

The Locomotive Improvement Company's locomotive went over the Burlington, Cedar Rapids & Northern Railway some time ago, and pulled such a heavy train, that the company equipped one of their own engines with the traction increaser. Several trials were made with the engine thus equipped, on a heavy hill near Cedar Rapids, Ia. She was tried with 22 loaded cars, but stalled. Then she backed down, and dropped cars till she was able to take the remaining load over the grade. The same trials were made without using the traction increaser, and it was found that the engine pulled as many cars as when the device was operating.

The communication and indicator diagrams from Captain Robbins, of Honolulu, which we publish on another page, would seem to indicate room there for placing first-class engines. With the high price of coal it would not trouble an enterprising manufacturer to give guarantees of saving that ought to secure him orders, while keeping well within bounds. Some of the diagrams are curiosities in the way of non-economical performance.

Commenting on our little joke in a recent issue about there being no doubt of "John Bull's ultimate ability to whip the Mahdi, now that he has called in the aid of American machinery and American mechanics," the *Machinery Market*, of London, says, "the calm assurance of this last remark is characteristic of our cousins across the herring pond." This rather implies that we are expected to furnish both the joke and the "surgical instrument," as Sidney Smith put it, needed to make it effective. Try again, brother.

Good Mileage.

Locomotive No. 84, belonging to the New York Central & Hudson River Railroad, made a remarkably good record on fast passenger service after she came out of the shops. She was put at once upon the Chicago express train, making the run from New York to Albany and back every day of the week. To do this long running, which aggregated 244 miles a day, two crews had charge, the men running on alternate days. D. Caffin pulled the throttle one day, and E. Stanford the next, and both were as good men as are to be found running any locomotives. Before the engine, which has the Buchanan fire-box, needed any work done to fire-box or flues, she had run 26 months. The total mileage was 165,000 miles. To do all this immense mileage the engine got nothing but light repairs to machinery, and nothing to heating surfaces. Considering that the water used is not the best in the world and the speed maintained is high, this record reflects great credit on those who turned the engine out and on the engineers who ran her.

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☞ *Positively we will neither publish anything in our reading columns for pay or in consideration of advertising patronage. Those who wish to recommend their wares to our readers can do so as fully as they choose in our advertising columns, but our editorial opinions are not for sale. We give no premiums to secure either subscribers or advertisers.*

☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draughtsmen, and all those especially interested in the occupations we reprsent, on subjects pertaining to machinery.*

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NEW YORK, MAY 9, 1885.

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Early Railroad Machinery.

Commenting on modern railway facilities at the suggestion of the paper read on the subject by Mr. Barnet Le Van, our contemporary, the *English Mechanic*, makes the statement that American railroads have nothing to show in the way of fast train speed that will compare with the Great Western train, run at the rate of 54 miles an hour, or a Great Northern train, making an average speed of 51 miles an hour. Our contemporary contradicts the assertion that the Baltimore & Ohio Railroad was the first passenger railroad in the world, and holds that although the building of the Baltimore & Ohio Railroad was contemporary with the building of the Liverpool & Manchester Railway, it was not until the utility of the locomotive was demonstrated by the latter, that the former company decided to operate by locomotives. This is a decided mistake which all English and most of American writers fall into. Not the success of the Liverpool & Manchester railway locomotives, but the success of Peter Cooper's small locomotive on their own road, led the directors of the Baltimore & Ohio Railroad to adopt locomotives for operating their traffic; and Peter Cooper's locomotive was built contemporaneously with the Rocket. That engine, diminutive though it was, demonstrated that a locomotive could pass round the curves on the Baltimore & Ohio Railroad safely, and pull a train.

The Gartner & Davis engines that did the first regular service on the Baltimore & Ohio Railroad, were constructed after the style of the Cooper locomotive, and its influence on the design of all early American locomotives was much greater than it has received credit for. Cooper and his contemporaries showed that American inventors and mechanics were perfectly capable of designing and building the machinery needed to operate railroads without receiving instructions from abroad. It is usual for our English cousins to claim the whole credit for the invention and development of railway machinery, and the claims are often acquiesced in by Americans through ignorance of our early railroad history.

While dealing with this subject, we would like to draw the attention of all interested therein to the fact, that the directors of an American railroad were the first in the world to decide that their railroad, built for passenger and freight traffic, should be operated by locomotives. When the directors of the Liverpool & Manchester Railway in England were disputing about what system of operating to adopt, the majority favoring stationary engines and rope traction, the directors of the Charleston & Hamburg Railroad, of South Carolina, unanimously decided to operate their railroad with locomotives, and gave their general manager directions to have locomotives built. The first locomotive built under this order was the "Best Friend of Charleston," a small engine with upright boiler and cylinders inclined, transmitting the power to the driving wheels through a cranked axle. The engine was built at the West Point Foundry, New York, and possessed no characteristics that indicated borrowing from early English locomotives.

The fact is, that applying the steam engine to locomotion was regarded as a much smaller mechanical feat in America than it was in England. The representative steam engine in Britain at the time railways were first started, was the heavy, slow moving condensing engine of Watt. Radical changes were necessary to convert that engine into a locomotive. America, on the other hand, had the high-pressure, high-speed engine, invented by Oliver Evans, and it was well adapted for land transportation purposes without change of type.

Sixty years ago, the need of improved methods of transportation was pressing hard upon the American people. Their success in applying the steam engine to the propulsion of water craft intensified the necessity for a system that would not be paralyzed by the frosts of winter. They were working out the land transportation problem, and their success in other lines of mechanical development leads us to believe that the mechanical progress of America would not have materially suffered, had Watt and Stephenson never been born, and their work in Europe had remained undone.

Unequal Taxation of Manufactories.

In these days of patent political reforms some effort should be made in legislative bodies towards reforming the inequalities of taxation. There are more ways to dodge taxation than to escape the penalties of a crime. The consequence is that those who are not skilled in the cunning arts pay an unjust proportion of the taxes. Laws seem to encourage tax dodging, and frequently the people deliberately vote to exempt some good property from taxation, thereby increasing the burdens upon their own shoulders. It used to be regarded as enterprising for the people at spring town meetings to vote a considerable sum of money out of their own pockets into the treasury of some railway company. This was usually a loan, but, when it was found that such loans were almost always perpetual and without interest, liberal enterprise became chilled. Within the last two or three years, however, it has broken out in a new direction. It is the fashion now at town meetings to vote exemption from taxes to certain manufactories for ten years, and towns that have not granted such a bonus to at least one manufactory are looked upon as either new and undeveloped or old fogyish. We believe in extending liberal encouragement to new manufactories, but fail to see any justice in helping one private establishment out of the public purse, and denying like assistance to other establishments of equal benefit to the community. There can be no such objection to voluntary subscriptions by citizens of any locality to aid new industrial ventures. But no one should be taxed one cent against his will to confer exemption upon any private enterprise. If any manufactory is to be wholly relieved from taxes, all should be relieved alike. Exact justice demands this.

Private Armed Forces in Industrial Disputes.

Recent occurrences at several places in the West have brought a problem to public notice that has not heretofore been pressed to the front. Several large and powerful railroad and mining corporations, after getting into a conflict with their employes over labor matters, causing the latter to withdraw from work, have immediately engaged gangs of "private detectives," fully armed with the most efficient modern weapons, to "protect their property." At first thought, this course may seem to be justified by existing conditions, when viewed in the light of occurrences that have followed similar disputes on other occasions; but examined a little closer, it will be found to have a different significance. All citizens are entitled to adequate protection of life, liberty, and property under the law, but the possession of large property does not carry with it the right, in this free country, to use any force for protection denied to the poorest and humblest individual. Efforts are always made to have these companies of armed "detectives" sworn in as special policemen, while acting under pay of the corporations. The feelings of a lot of workmen, who are guilty of neither violence nor pillaging, but who are peaceably waiting for a settlement of the dispute which caused them to be idle, upon being threatened and bullied by a gang of armed men brought from a distance, and acting *under cover of law*, can better be imagined than described. In such cases, workmen are apt to give emphatic expression to their opinions upon such proceedings, which are caught up and recorded by the daily press as "mutterings and threats of agitators that are in danger of breeding riot." Any collision resulting from such provocation is sure to be depicted for the information of the public in a way greatly to the disadvantage of the workmen. Fortunately, the civil authorities are seldom led into the inexcusable blunder of commissioning an armed force engaged by a private corporation as special policemen. When the usual police force is not sufficient to preserve the peace and protect everything that needs protecting, other resources are provided by law that can be made available. No party to an industrial dispute should ever be allowed to have its armed retainers authorized by legal power to stand guard over or menace the other party to the same dispute.

Science and the Steam Engine.

A young correspondent writes us saying, that he had heard the steam engine spoken of as a "towering monument that Science had erected for Industry," and he asks us who were the scientists that took the lead in building up the structure referred to? We are aware that it is common for certain speakers to express themselves about the steam engine in the hyperbolical style referred to by our correspondent, but the claim that science has developed the steam engine seems to rest on a very frail foundation. The steam engine has reached its present condition without receiving any important aid from what is generally understood as science or its special apostles. That steam might be applied as a motive power has been known to scientists for more than twenty-one centuries. Generation after generation of philosophers amused themselves with steam for two thousand years, and at the end of that time they were no farther advanced in applying steam to useful purposes than they were at the beginning. There is no estimating the tomes of speculations about the possible force that might be derived from steam that passed quietly to oblivion since experiments were first tried to make steam do work; but it is certain that the philosophers who were speculating about steam in the beginning of the 18th century had not succeeded in raising the engine above an impractical toy, no better for useful purposes than was the engine used by Hero of Alexandria two thousand years earlier. It remained for an unlettered mechanic to apply steam to a piston moving in a cylinder, and thereby give the germ of the practical steam engine to the world. The numerous improvements that have been effected on the steam engine since Newcomen's time have also originated principally with mechanics. The higher class of scientists have been by no means silent respecting the steam engine, and they have labored assiduously upon it at various times, but their work has generally been devoted to demonstrating its imperfections. At frequent intervals the exponents of science have taken pleasure in reviling the steam engine and expatiating upon its enormous waste of heat, but the same parties who are so glib at figuring up all the losses inherent to the best steam engine, do nothing more than talk vague generalities when requested to indicate some line of improvement. There is no denying that at best the steam engine is a wasteful vehicle for transforming the potential energy of carbon into useful work, but there seems no near prospect of a more economical substitute being found. The belief entertained by certain scientists that electricity will eventually be obtained direct by the oxidation of carbon is a mere speculation, No discovery has been made that indicates any probability that electrical energy will ever be derived direct from coal; and the chances that it may eventually be done are very remote, quite as unlikely as that the steam engine may be improved till 80 per cent., instead of 12 per cent., of the potential energy will be utilized.

Considering the begrimed condition of most British cities from the deposits left by unrestrained smoke, it is not surprising that an agitation is being kept up over there against the free emission of smoke in limitless quantity wherever a fire is burned. Science has said that smoke is an expensive superfluity due to defective methods of combustion, and inventors have supplied the furnaces for burning coal without producing a smoke nuisance. This being the case, it would appear nothing was wanted but pub-

lic sentiment against smoke to prevent crude methods of combustion being followed. That sentiment is growing rapidly on the other side, and it now appears in order that the sanitarians of Pittsburgh, Chicago, and other smoke infested cities, should develop sentiment in these places to secure cleanliness and purity of air.

Literary Notes.

THE CIVIL ENGINEER'S POCKET-BOOK OF Mensuration, Trigonometry, Surveying, Hydraulics, Hydrostatics, Instruments and their Adjustments, Strength of Materials, Masonry, Principles of Wooden and Iron Roof and Bridge Trusses, Stone Bridges and Culverts, Trestles, Pillars, Suspension Bridges, Dams, Railroads, Turnouts, Turning Platforms, Water Stations, Cost of Earthwork, Foundations, Retaining Walls, etc., etc., etc. In addition to which the elucidation of certain important principles of construction is made in a more simple manner than heretofore. By John C. Trautwine, C. E. Revised, corrected and enlarged by John C. Trautwine, Jr., C. E. New York: John Wiley & Sons, 15 Astor Place.

It is hardly necessary to say anything in favor of a work of which 22,000 copies have already been sold. It is, deservedly, one of the most popular of pocket books, because the information it contains is presented in such plain terms as to be readily comprehended by those who have not had the advantages of a technical education. Although more particularly designed for civil engineers a great deal of the matter it contains is equally valuable to mechanical engineers, by whom it is largely used as a reference book. As enlarged, it makes a book of 832 closely printed pages, containing an amount of information seldom found in a single book. Every statement is in the fewest words that will clearly convey the meaning, no space being occupied by unnecessary words. The price, in Morocco flap and gilt edge, is $5.

TABLES FOR FIELD ENGINEERS, DESIGNED FOR USE IN THE FIELD. Tables Containing all the Functions of a One-Degree Curve, from which a Corresponding One can be found for any Required Degree. Also Tables of Natural Sines and Tangents. By Amos Stiles, C.E., Philadelphia. Published for the Author.

This book is of convenient size, and we should suppose would be well received by those who have use for such tables.

WATCH AND CLOCK MAKING. By David Glasgow, Vice-President of the British Horological Institute. With 69 Diagrams. Cassell & Co., Limited, New York.

This is a book of nearly 350 pages, neatly printed and illustrated. The author, in his preface, says: "This volume is intended not only as a text book for technical classes, but is designed also as a book of reference for practical workmen." Without attempting critical judgment of the work, we are very favorably impressed with its value. It sells for $2.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.

(146) C. G., ——, Mass., asks: 1. Can steel castings be chilled in casting, the same as cast iron? *A.*—We are not aware that this has ever been practiced. 2. What would be the weight of a steel casting 36″ long, 18″ wide, and 9″ thick? *A.*—It would depend upon the quality of the casting. Probably about 1,600 lbs.

(147) C. L. C., Springfield, Ohio, asks: 1. What should be the grate surface for a tubular boiler 40 inches diameter, 9½ feet long with 40 tubes? *A.*—You do not give the size of tubes. Assuming them to be 3,″ a grate surface of 14 feet will be about right. 2. How much space should be left between back end of boiler and wall? *A.*—For convenience in cleaning, etc., about 24 inches

(148) N. J. R., Denver, Col., writes: Can you tell me how to keep blower boxes cool? The shaft and boxes are both cast iron, 10 inches diameter, speed 280 and 140 revolutions per minute. I have tried salt and black lead and different kind of lubricants, but experience difficulty in keeping bearings from burning. Have been advised to use sulphur, but am afraid, as we run continuously, stopping only one hour each month. Have tried various kinds of lubricants. *A.*—We do not know the pressure per square inch on bearing surface. It may be so great as to make heating always probable. We think you would have better success by boring out the boxes, smoothing the journal, and lining the boxes with best babbitt metal. You seem to have tried about all you can except the sulphur, which you need not be afraid to try. If you succeed in keeping the journals cool it will be by trial, as of different lubricants. No one can tell, except by trial, what will accomplish it.

Business Specials

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Katzenstein metallic packing, 169 Christopher st, N.Y.

Edw. Sears, wood engraver, 48 Beekman, St, N.Y.

Presses & Dies, Ferracute Mach. Co., Bridgeton, N. J

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass

"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 86 John street, N. Y.

Tools for amateur and foot-power lathes. Send for illustrations. Hartford Tool Co., Hartford, Ct.

Light fine interchangeable mach'y to order. Foot lathe catalogue for stamp. E. O. Chase, Newark, N.J.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn

Foot Power Machinery, for workshop use, sent on trial if desired. W.F. & John Barnes, Rockford, Ill.

The latest Improved Tack and Match Machinery is made by White Machine Co., Waterbury, Conn.

Pattern and Brand Letters. Vanderburgh, Wells & Co., corner Fulton and Dutch streets, New York.

Consulting Engineer and Mechanical expert, C. C. Hill, 84 Market street, Chicago, Ill.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Split pulleys cheaper than plain ones. Trial orders solicited. York & Benton, Cleveland, Ohio.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

The outline ("wax process") engravings shown in the AM. MACHINIST each week are made by Struthers, Servoss & Co., 32 Frankfort Street, N. Y.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large; prices low. Frasse & Co., 62 Chatham St., N. Y.

Farley's Reference Directory of the Machinists, Iron, Steel, and Metal-Working trades of the United States. A. C. Farley & Co., Philadelphia, Pa.

A few chucks, of all kinds, for sale at half price. Slightly damaged. Send for list to the maker, A. F. Cushman, Hartford, Conn.

"Complete Practical Machinist," $2.50; "Mechanical Drawing Self-Taught," $4. Books for workmen Joshua Rose, Box 3206, New York City.

Locomotive Engine Running and Management. By Angus Sinclair. Price $2. An excellent book for men interested in steam engineering, valve setting, designing valve motion, the care of the Westinghouse brake, etc. Published by John Wiley & Sons, 15 Astor Place, N. Y.

Useful Information for Steam Users—A 100-page pamphlet, on the care and management of the steam engine and boiler, with hints and rules for engineers and firemen. Every engineer should have this book. Send 25c. in P. O. stamps to the J. N. Mills Publishing Company, 145 Broadway, N. Y.

Every young man who aspires to be either a mechanic, merchant, or manufacturer, owes it to himself that he become thoroughly familiar with the writings of Chordal. John Wiley & Sons, 15 Astor Place, N. Y., have issued a new and enlarged 12 mo. edition of "Extracts from Chordal's Letters." Handsomely bound in cloth, with over 50 illustrations. Price, $2. Discount of 25 per cent. on orders for five or more copies.

Manufactures.

A woolen factory is to be erected at Abilene, Texas.

Roberts, Winter & Co., Kingston, Tenn., will soon build a new foundry.

Preston & Herman, Corning, N. Y., will rebuild their foundry recently burned.

There is a car factory in Ellaville, Fla., with a capacity of 10 cars per day.

Thomas Kingsford will rebuild his planing mill at Oswego, N. Y., recently burned.

L. P. Haslup, carriage manufacturer, Baltimore, will erect a 4-story factory, 30x33 feet.

The Gendron Iron Wheel Co., Toledo, Ohio, will build a three-story addition to their factory.

T. M. Chapman, Oldtown, Me., proposes to build a foundry in connection with his machine shop.

The Sherman Manufacturing Company, Jackson, Tenn., are building an additional machine shop.

John Ingram, of Vanceburg, Ky., contemplates establishing a plow factory in Chattanooga, Tenn.

Peck, Bros. & Co., brass goods manufacturers, New Haven, Conn., will build an addition to their foundry.

C. C. McKinnon and others have organized a company to build a cotton-seed oil mill at Aberdeen, Miss.

It is reported that the Louisville & Nashville Railroad will build new shops, to cost $60,000, in Louisville.

Francis Storms will erect four factory buildings at North 11th and 2d Streets, Brooklyn, N. Y.,, to cost $40,000.

The Sloss Furnace Company, Birmingham, Ala., intend to build another furnace as soon as the iron trade improves.

Weeks & Redhead, Oswego Falls, N. Y., are interested in a proposed agricultural implement factory for that place.

Lodge, Barker & Co., Cincinnati, Ohio, are running full time on machine tools and special machinery, employing 65 men.

John Pfeifer, Tioga, Pa., will build a four-story shovel factory on Race Street, between Second and Third Streets, Philadelphia.

The Straight Line Engine Company, Syracuse, N.Y., have just shipped an 8″x14″ engine on a cable order to Manchester, England.

H. A. Furbush & Sons will build a large addition to their cotton and woolen mills at 8th and Mountain Streets, Philadelphia, Pa.

E. H. Funk, of Sturgis, Mich., will build a two-story machine shop and a foundry at Toledo, Ohio. Over 50 men will be employed.

The new tool factory of J. A. Bissonette, St. Louis, Mo., will employ about 100 hands. It is expected to be ready by July 1.

The Scoville Brothers, of Haddam, Conn., are about to enlarge their works. They are now making over a hundred hoes a day.

The Atlantic Refining Company, 307 Walnut St., Philadelphia, will build a two-story machine shop in connection with their refinery at Point Breeze.

A new machine shop has just been built at Johnson City, Tenn., 50x100 feet, two stories high. Connected with this is a new foundry 90x125 feet.

The Anoka (Minn.) Board of Trade is considering the proposition of outside parties to start an iron mill, provided a certain amount of stock is taken.

The Diamond Wrench Manufacturing Company, Portland, Me., contemplate soon enlarging their works so as to increase the capacity to 50 dozen per day.

The Swift Manufacturing Company, Columbus, Ga., will erect an additional building for their cotton mill, to be used in the manufacture of bed spreads.

Melvin Stevens, 41 Dey Street, New York, has improved his planer vise by making the jaws of cast steel instead of iron. This gives greater strength.

The Savannah Cotton Press Association, of Savannah, Ga., intend to put up another press and boilers this spring. Superintendent, Samuel J. Whitesides, Savannah, Ga.

The Victor Well Auger and Machine Co., 904 Olive Street, St. Louis, Mo., are now putting up large shops at Kearney, Neb., and intend shortly to put in shops at Dallas, Texas.

The New York Dyewood Extract and Chemical Company, 161 Front Street, N. Y., will erect, on Freeman Street, Brooklyn, N. Y., a four-story brick factory, 62x58 feet, to cost $15,000.

The Union Iron Mills, Pittsburgh, Pa., Carnegie Bros. & Co., limited, have secured orders for two bridges, each one mile long. The material is to be made of steel, and will require 50,000 tons.

W. C. Duyckinck, 50 John Street, New York, has issued a new 200-page price-list of machinists', engineers' and railroad supplies. It is compact (without cuts) and being well indexed can be readily used.

The Machinists' Supply Co., of Chicago, Ill., formerly doing business under the same title, has been incorporated for the purpose of manufacturing railroad and machinists' supplies. Capital stock, $25,000.

Randolph Brandt, 38 Cortlandt Street, N. Y., reports that his sales of Selden piston packings in March were greater than for any month in the past two years. Orders have been good since the first of the year.

Carnegie's Bessemer Steel Works, at Homestead, Pa., will shortly double their capacity, and will manufacture exclusively structural steel. The change will throw a large number of puddlers out of employment.

The Whitney Arms Manufacturing Company of New Haven, is rushing its works day and night to fill orders for arms for foreign powers. A large part of the guns ordered are believed to be for the Russian Government.

Frost & Adams, Boston, Mass., have issued a special catalogue of mathematical instruments and drawing materials. The plates are extra well printed on heavy paper, and show a great variety of drawing instruments.

The Harrington & King Perforating Company are putting up a brick factory building 40x150 feet in size and two stories high, at 224 and 226 North Union Street, Chicago, and expect to get into the same by May 10.—*Industrial World.*

E. F. Brock & Co., of Rock Falls, Ill., have sold their entire plant and good will to Geo. W. Packer, formerly of Sandwich, Ill., who will carry on the manufacture of machinists' tools, lathes, punches, and shears, and butter-tub machinery.

The Union Iron Works, Newark, Ohio, recently incorporated to make general machinery and castings, will probably use the Blandy shops. Corporators are James H. Smith, Luthur I. Johnson, James W. Collins, W. C. Smith, William H. Lone and John C. Hamilton.

Z. T. Furbish, the Augusta inventor, has leased J. O. Dunham's machine shop in Richmond, Me., and will engage in the manufacture of the American Shaving Machine, a contrivance which is the joint invention of himself and J. G. Lake, of Richmond.—*Industrial Journal.*

Fifty-one of the solid men of Charlevoix, Mich. have signed a call for a public meeting of all "who favor a movement to induce parties to this locality with capital for manufacturing purposes, or to otherwise develop the resources of this village and vicinity."—*Grand Rapids Morning Telegram.*

Instead of following the movement among New England manufacturers to pay weekly instead of monthly, the Kalamazooloos are reversing the process. The Kalamazoo (Mich.) Buggy Works recently changed their pay day from weekly to monthly, and two-thirds of their employes walked out.

The Garden City Fan Company, Chicago, write us: Our present business seems something like a boom. Our trade in exhaust fans, blowers and boring machines is good, besides an order for 100 steam engines (5x7 cylinder) for Davis & Rankin, of this city; it looks as though we would be obliged to work overtime pretty soon.

Now that it is a foregone conclusion that the Washington Mills, of Lawrence, Mass., are about to be sold, many of the former employes are anxious to know what disposition is to be made of the relief fund, which amounts to nearly $10,000, and was contributed by the operatives during the past twenty years.—*Boston Commercial Bulletin.*

Wm. Weiler, an engineer at Port Morris, N. J., has invented and is manufacturing an easy seat for engineers, firemen and conductors, that is highly spoken of among railroad men. Its use takes away the sharp jar of a locomotive or caboose, and prevents the men from suffering from the kidney or other troubles that result from constant jarring.

The Woodstock, Va., Foundry and Machine Shops will, says the *Virginian*, be reopened soon, under the management and control of Mr. John Halliday, a practical workman, who is now preparing to manufacture cotton, woolen, flour and saw-mill machinery, plows, hay cutters and general repairs, also machinery to cast gearing and pulleys without patterns.

The new "Duplex" printing press, invented by Joe Cox, of Battle Creek, Mich., has been completed, and at its trial proved a perfect success. It is the "pony" size, but on account of its success a newspaper size will soon be commenced. The press was manufactured by the Union Manufacturing Company of Battle Creek.—*Grand Rapids Morning Telegram.*

The people of South Toledo, Ohio, voted to appropriate $10,000 for the Toledo Improvement Co. if they would move there from Toledo, and ground has already been purchased and plans drawn for the factory. The company, in accepting the offer, bind themselves to employ at least 25 men the year around. Work on factory will commence at once. Estimated cost, $10,000.

The New York Engineering Company, 64 Cortlandt Street, have just issued "Circular A," of the Stow Flexible Shaft and accompaniments, for which they are agents. The circular is illustrated with engravings showing some of the uses of this very convenient arrangement for drilling, counterboring, etc., and contains descriptive matter of interest to mechanics and manufacturers.

The city of Columbus, Ga., have contracted with "The Gamewell Fire Alarm Telegraph Company," of New York, for a complete outfit for a telegraph fire alarm, with 16 signal boxes. They have also contracted with the Columbus Iron Works for the erection and satisfactory operation of the same, for the sum of $3,500, which will be done under the supervision of Mr. E. W. Jenkins, of Columbus, Ga.

The Gardner Governor Company, Quincy, Ill., write us: We are much pleased with the business outlook. Our last week's mail brought us in orders for more governors than any preceding month in the past year. We believe the volume of our business will largely exceed that of last year. Everything points to a prosperous year with us, and we see no reason why this feeling should not be general.

The Columbus (Ga.) Iron Works Company are negotiating to erect two of H. D. Stratton's 10-ton ice machines, and a cold storage house, for a stock company in Savannah, Ga. Mr. Knight, as representative for the Savannah company, has been spending several days in Columbus watching the workings of plant erected here by the above company for the Columbus Ice & Refrigerating Company.

Knowlson & Kelly have just completed for a wealthy resident of Cuba, a locomotive for use on a narrow gauge road on a sugar plantation. The trial proved very satisfactory, and the engine will be taken apart and packed for shipment. It is about one-third the size of an ordinary railroad locomotive, and has been made with the utmost care. It is the second one of the kind manufactured by Knowlson & Kelly for Cuban planters, and one has been made and sent to Mexico.—*Troy, N. Y., Evening Standard.*

Machinists' Supplies and Iron.

NEW YORK, April 23, 1885.

A ramble among supply dealers gives the impression that they are rather less dissatisfied with the condition of trade to-day than they were a week ago. We inferred from this that signs of improvement were visible. Sales are made on extremely close margins of profit.

Iron—The demand for pig continues sluggish. Supply is strictly regulated to suit the limited demand, and prices continue fairly steady. We quote Standard Lehigh brands $18 to $18.50, for No. 1 X Foundry; $17 to $17.50 for No 2 X, at tidewater, and $14.50 to $15.50 at furnace for Grey Forge. About 50c. to $1 below these figures represents the value of other brands.

Scotch Pig continues depressed, with quotations almost nominal. We quote Shotts, $21.50; Coltness $21.50; Glengarnock, $19 to $19.50; Gartsherrie, $20.50; Summerlee, $20.50; Carnbroe. $19, all to arrive.

Copper—Ingot is firmer, with an upward tendency. Lake has sold at 11.05 cents, and other brands from 10⅜ to 10¾ cents.

Lead has been firm, although the demand has been light. Sales have been made from 3.62 to 3.63 cents.

Tin has advanced during the week. We quote for jobbing lots, Banca, 19c.; Straits and Malacca 18.20c.

✻WANTED✻

"Situation and Help" Advertisements, 30 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Position wanted—supt or chief draftsman. Address J. C. S., AM. MACHINIST.

Situation by first-class patternmaker accustomed to make working drawings. T. C., AM. MACHINIST.

Wanted—Situation as foundry supt. or foreman. Address D. E., AM. MACHINIST.

Wanted—Situation by die and toolmaker; 18 years' experience. Address X. L., AM. MACHINIST.

Wanted—An intelligent young man, who is a first-class machinist and accustomed to die work. J. Crossley, Trenton, N. J.

Situation as foreman by first-class machinist and toolmaker; good draftsman; best of references. Address Indicator, 135 South 6th St., Reading, Pa.

Wanted—A competent yonng man to do drafting and office work. Address Phœnix Foundry and Machine Company, Syracuse, N. Y.

Wanted—Work by an industrious young man, having 5 years' experience in machine shop and drafting room. Address H, AM. MACHINIST.

Mech. draftsman competent of making accurate and neat drawings, also some designing, wants situation. Address O. M., AM. MACHINIST.

Wanted—Situation by a competent mechanical draftsman, experienced in designing steam engines, boilers and general machinery. Specialty, steam and gas engines. Address A, Room 232, Stewart Building, N. Y.

Wanted—Position as foundry foreman; large experience in all kinds of machinery castings and general management of men and foundry business. Locomotive work preferred. Reference first-class. Address A. R., Box 202, Schenectady, N. Y.

Position as draftsman, for young man now in my employ; graduate of German technical schools; had practical experience as machinist and draftsman on marine and stationary work. Randolph Brandt, 38 Cortlandt Street, N. Y.

Wanted—A party as superintendent for an establishment building hoisting and mining machinery: must be fully competent. Address, stating salary expected, with references, V, Box 8, AM. MACHINIST.

A mechanical engineer, with 23 years experience in good shops, desires superintendency of works manufacturing stationary engines, general machine work or machine tools. Unexceptionable references. Address Planimeter, AM. MACHINIST.

Draftsman Wanted—Must be experienced in practical machine design and construction, and should have some theoretical training also. Position permanent. Address, stating age, past experience, references, and compensation expected. The Yale & Towne Mfg. Co., Stamford, Conn.

Wanted—Superintendent in machine shop; one conversant with printer's machinery preferred; one capable of getting trade and retaining it, and having $3,000 to $4,000 to invest; can have good situation and a percentage or interest in business. Address "Press," AM. MACHINIST.

Wanted—A competent engineer to take principal charge of the engines, boilers, and steam heating plant of a large manufacturing establishment in Philadelphia. Must be thoroughly conversant with use of the indicator, and well informed on steam matters generally. A suitable man will secure a permanent and desirable position. References required. Address Quaker City, care AM. MACHINIST.

Wanted—Carload pattern lumber. Geo. Lombard & Co., Foundry, Machine and Boiler Works, Augusta, Ga.

For Sale—An interest in three separate inventions on car brakes. For particulars address J. J. Henry, No. 3 Second Street, Baltimore, Md.

Wanted—To purchase a small boiler shop and tools, in good location. New York State preferred. Address E. D. S., AM. MACHINIST.

To make room for larger tool, will sell cheap, for cash, a planer 42"x42"x12', in good order. Address P. O. Box 2085, Bridgeport, Conn.

Wanted—The right party to take an interest with me in my very extensive works - machine and boiler shop and foundry. Address E. R. Smith, Jackson, Mich.

A valuable patented machine for pattern work; sells readily; good profit; no competition. $2,000 will purchase above patent, with patterns, etc. Engagement in business of different nature cause of selling. Address "Wood Worker," AM. MACHINIST.

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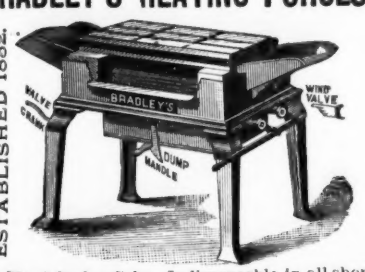

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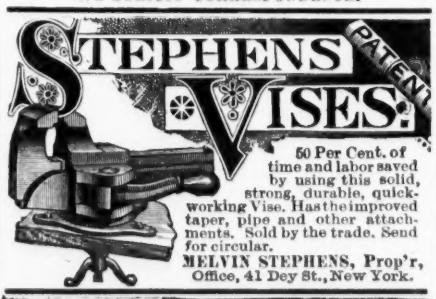

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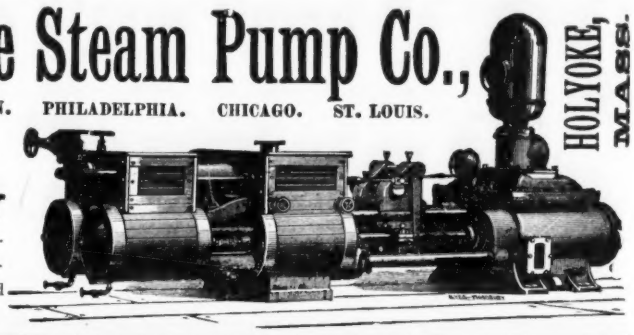

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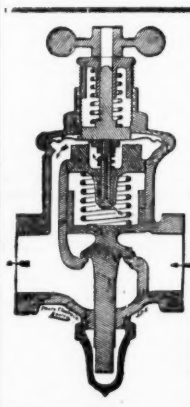
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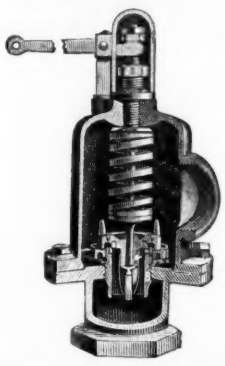

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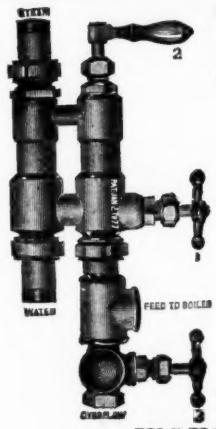

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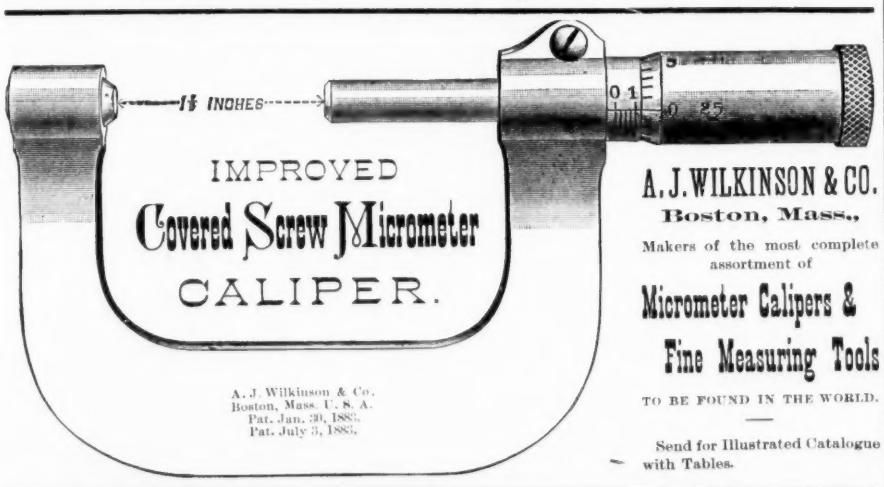

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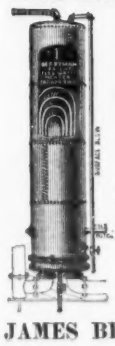

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3	¾	.40	9	2½	1.20
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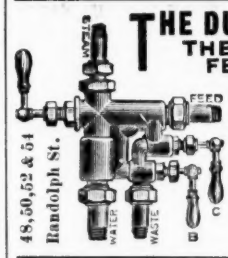

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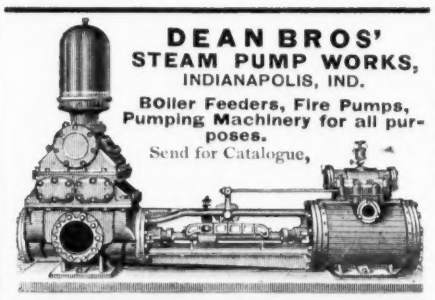

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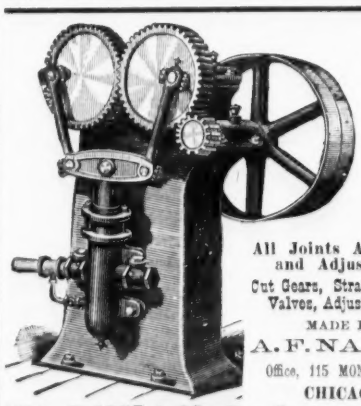

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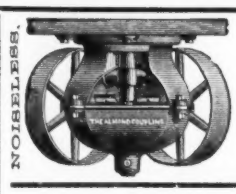

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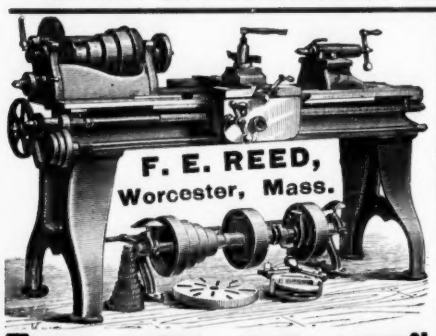

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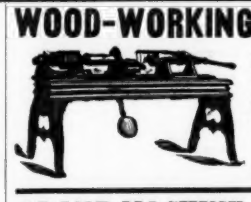

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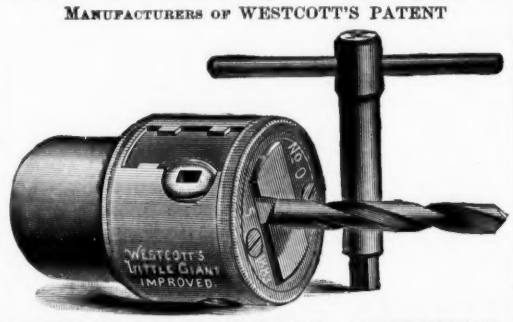

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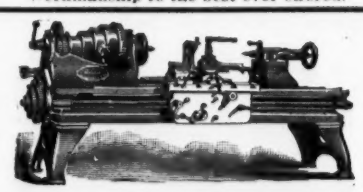

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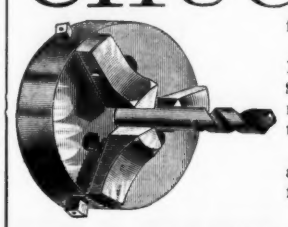

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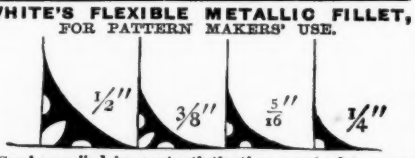

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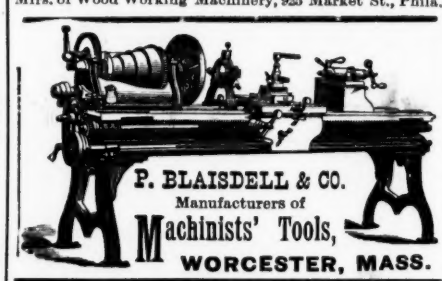

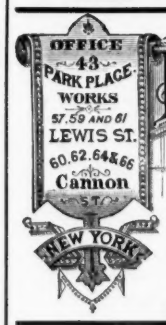

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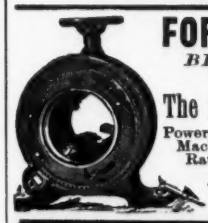

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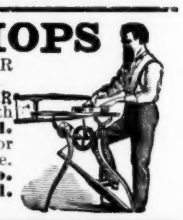

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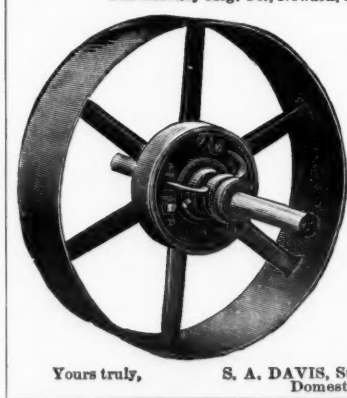

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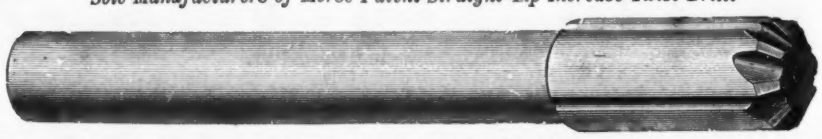

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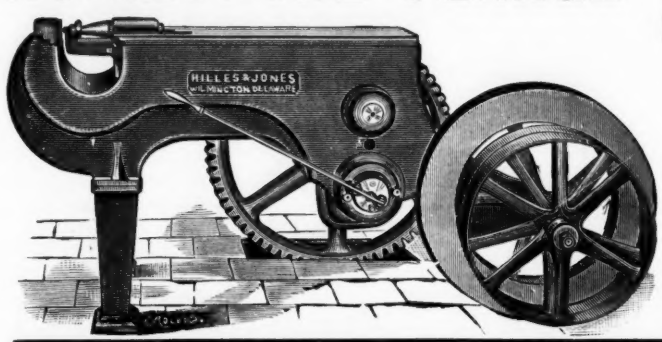

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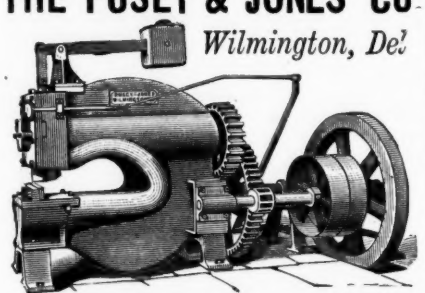

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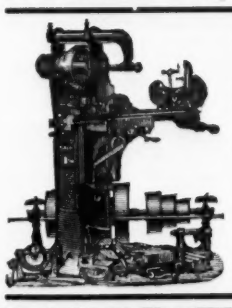

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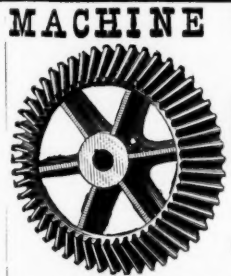

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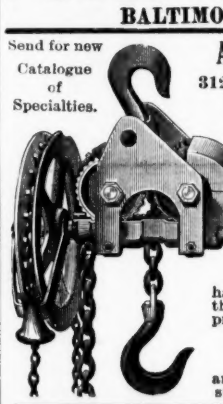

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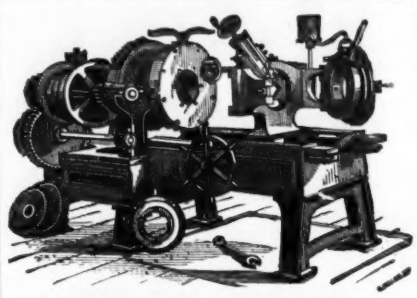

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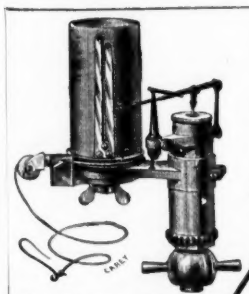

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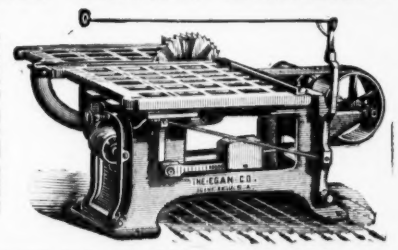

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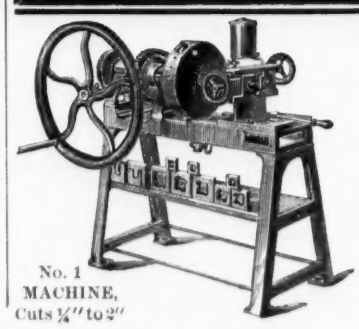

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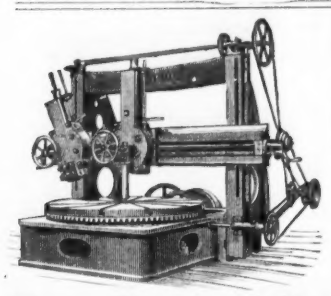

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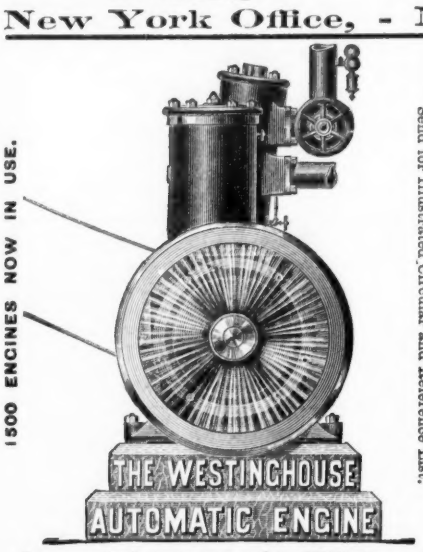

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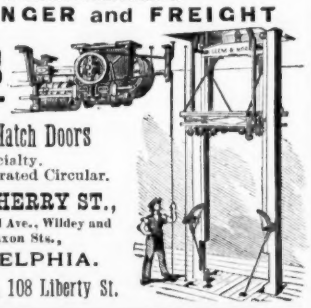

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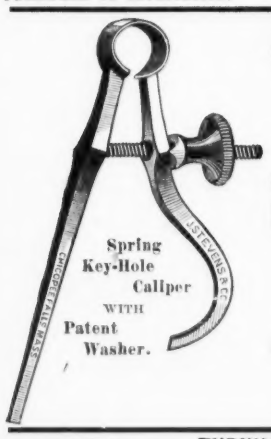

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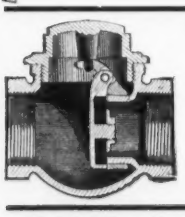

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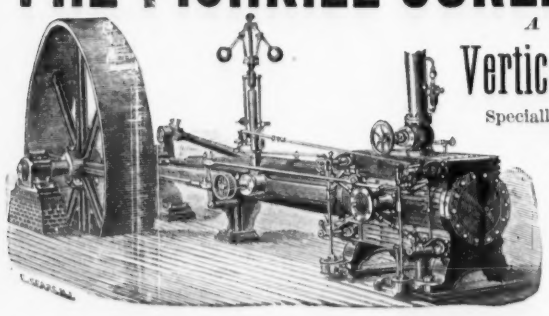

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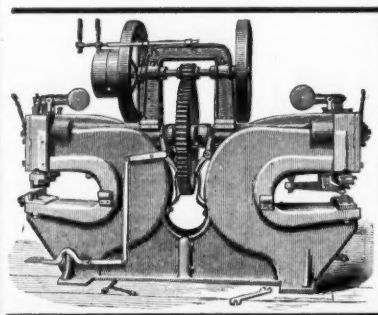

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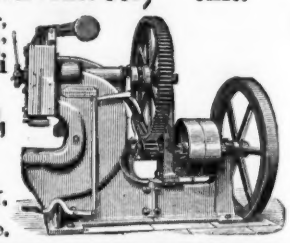

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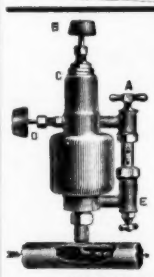

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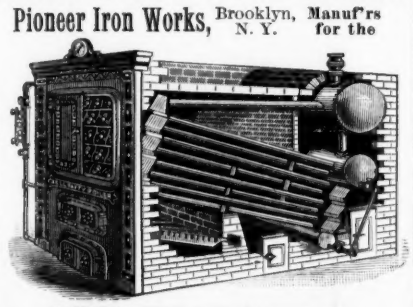

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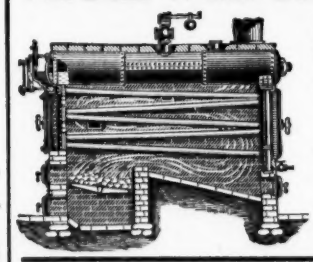

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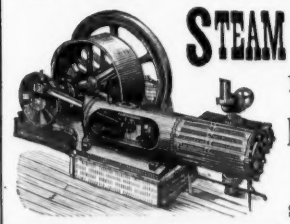

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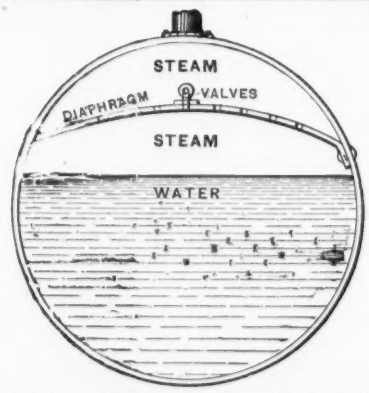

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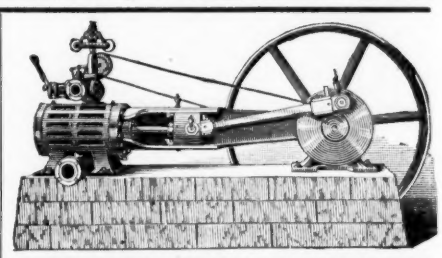

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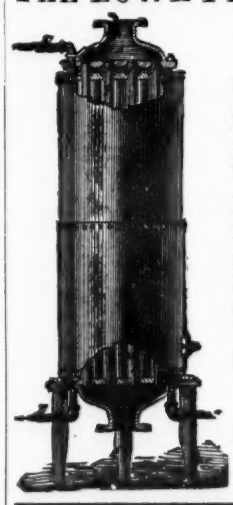

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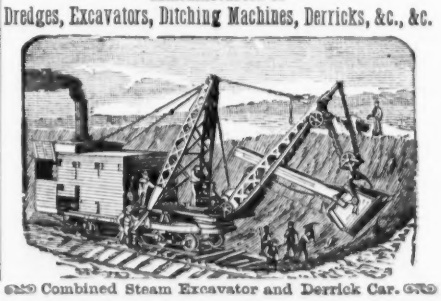

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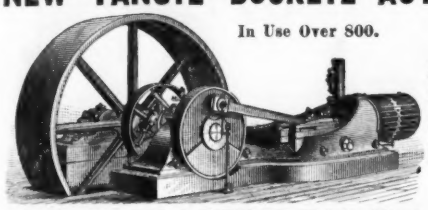

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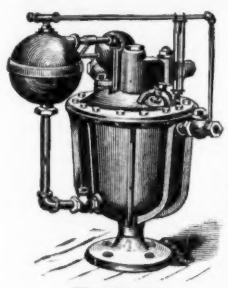

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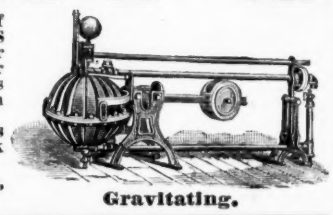

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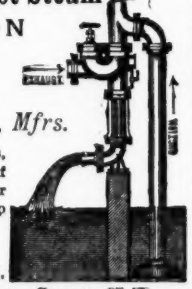

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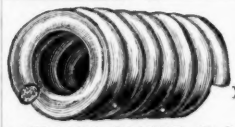

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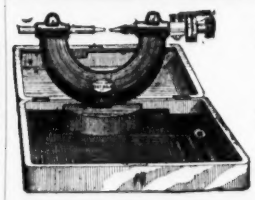

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16 in. x 6 ft. Engine Lathe. Ames. Good order.
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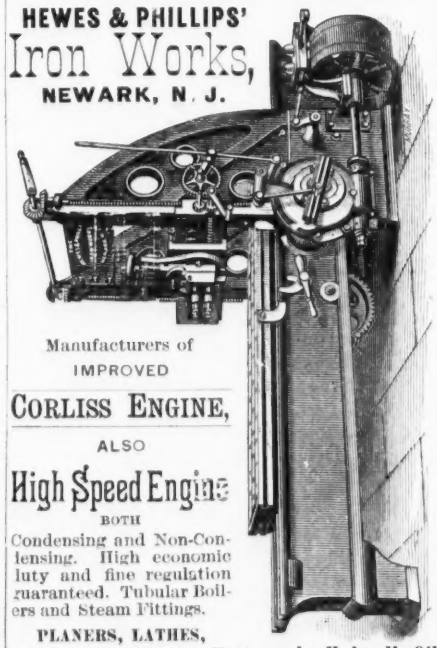

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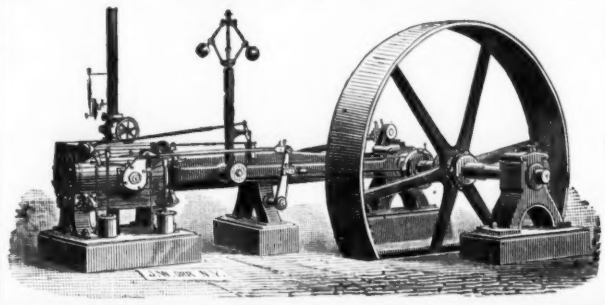

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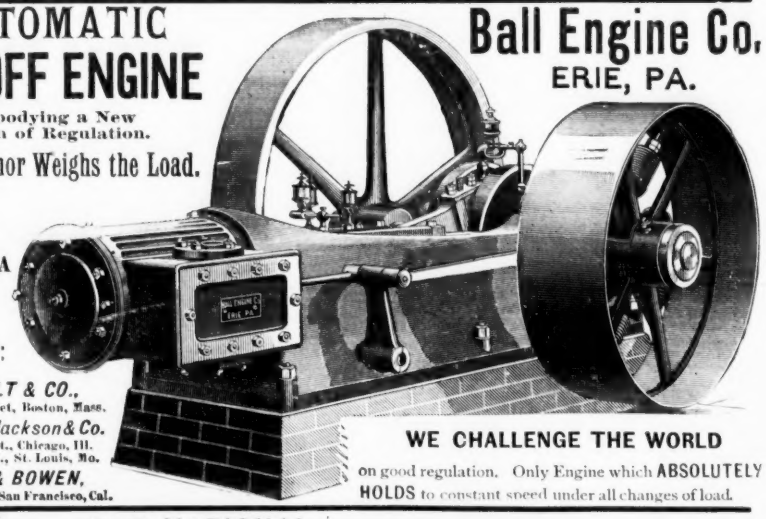

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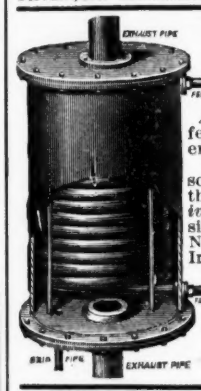

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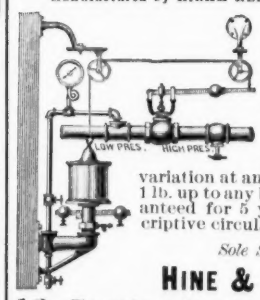

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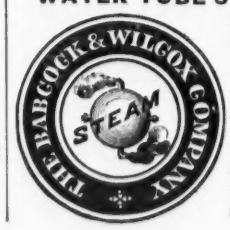

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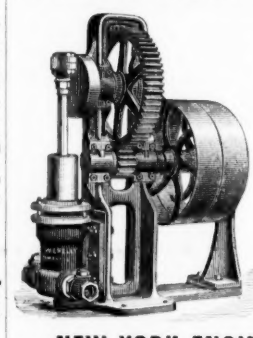

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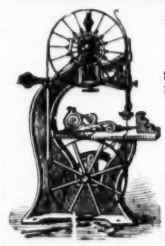

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Two Engine Lathes, 87 in. swing, 20ft. bed. Comp'd rest. Screw feed geared in face plate on each.
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Gentlemen:—Having used one of your smaller Universal Grinding Machines for four years and another of the larger size for nearly two years, it gives us pleasure to say that they produce economically and well all the kinds of work for which they are intended and we could not dispense with them. Yours truly,
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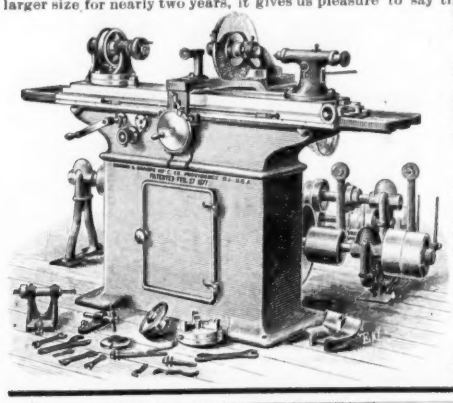

Wm. Sellers & Co., Philadelphia, Feby. 7, 1885.

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Gentlemen:—In reply to your inquiry of the 6th inst., we have to say that we have been using your "Universal Grinding Machine" almost constantly since June, 1880, with very satisfactory results. We hope to add more to our plant as business increases. Yours truly,
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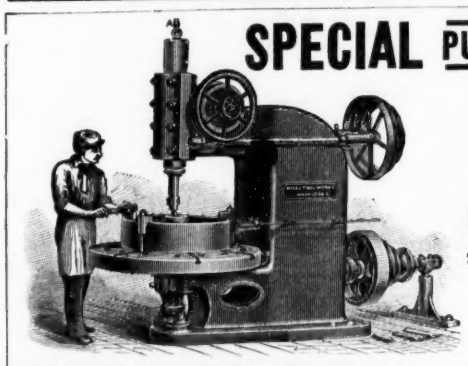
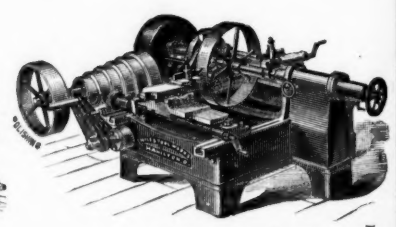
SPECIAL PULLEY MACHINERY.
36, 50 & 60 in. Swing.





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The manufacture of pulleys comprises quite a large part of our business, and we looked over the field considerably before purchasing of you, and this, with two years' experience, enables us to say, we think them **THE BEST PULLEY MACHINES** in the market.

Very truly yours, **W. McGREGOR & CO**

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FRICTION CLUTCHES
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Made wholly of metal—No wood or leather surfaces. Entirely free from Collar friction or End thrust. Run without noise, and without loss of power in driving. Friction Surfaces are of flat sheet metal, easily renewed.—Adjustments are simple, easily made and positive; easily applied, the working parts all attached to a Central Sleeve.

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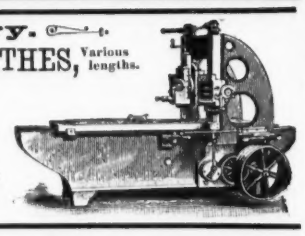

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with 6 in. x 10 in. stroke.

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with 12 in. and 14 in. stroke, all feeds automatic.

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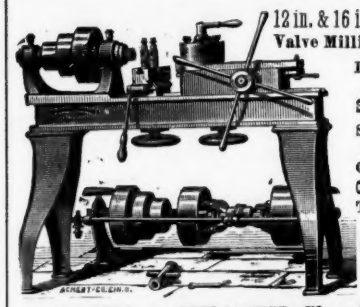

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Valve Milling Mach's
Double Key Lathes,
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Slide Rests, Revolving Chucks for Globe Valves, Two-Jawed Chucks, Small Tools and Fixtures.

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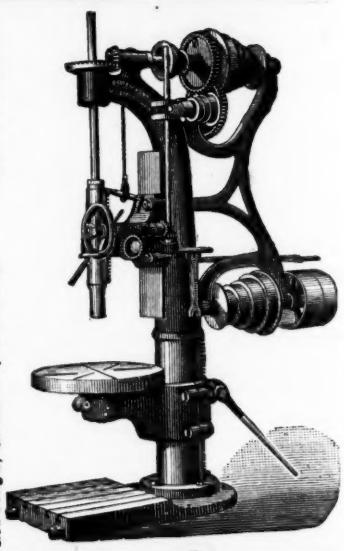

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20 in. Drills a specialty.

Our 20 in. Drill is a heavy substantial tool, made for service, has steel shafts and spindle. Gears and racks cut from the solid and have all modern improvements, are made by special machinery, and sold very low.

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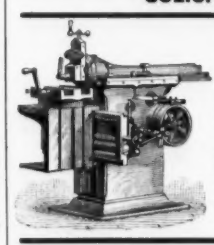

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